# REM SLEEP PATTERNING AND DREAM RECALL IN CONVERGERS AND DIVERGERS

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"The form and direction of drive discharge is coordinated with, if not limited and selected by, defensive organizations..... This does not mean that style and defense organization are identical, but it does imply that, in the main, both are tools of cognition, used primarily in its dealings with the internal needs of the organism."

(David Rapaport in <u>Organization and the Pathology of Thought, 1951</u>)

I declare that this thesis has been composed by myself and that the investigation described herein has been designed and carried out by myself.

# CONTENTS

## PART 111



## PART 1V



## APPENDICES

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## INTRODUCTION

It is often difficult to recall just how one first stumbled on an idea. Almost inevitably - directly or indirectly, consciously or unconsciously - the first formulation rests on plagiarism. In this case, my research sprang from a footnote in Liam Hudson's Contrary Imaginations:

> "It would be interesting to know, too, whether convergers and divergers differed in the nature of their dreams. One might predict that convergers are more likely to forget their dreams rapidly and completely."[1]

Liam Hudson himself attributes the suggestion to Oliver Zangwill. Finding myself saying, "Now why didn't I think of that?", I was hooked. Hurriedly putting together a research design, I approached Liam Hudson - only to find that another of his students, Mark Austin, had already embarked on the very same study. By this time, indeed, the data were being analysed. The results were highly encouraging - convergers were poorer than divergers at recalling their dreams. The problem now was one of interpretation. What was needed was a more discriminating design. At this point, Mark Austin bowed out - the rigours of all-night sessions were not to his taste - and I stepped into the breach.

My research brings together three quite disparate strands - psychoanalytic theory, mental testing and the electrophysiological recording techniques of the sleep

1 Hudson (1966), p. 98.

laboratory. This proved, at times, an uneasy marriage. Psychological researchers, striving for scientific respectability, typically view psychoanalytic theory with the utmost suspicion. An entertaining theory for lighter moments, to be sure, but not one on which to base research. Certainly, the processes which concern psychoanalytic theory do not, by their very nature, surrender readily to a direct research attack. As a result, psychoanalysis has generated little by way of experiment for a theory of such long standing. Yet, if psychology is not to remain largely 'academic', it should incorporate just such theories as psychoanalysis within its scope - not as some global doctrine, but as a series of hypotheses worthy of empirical scrutiny. The methodology must be found to fit the subject matter, rather than allowing 'the cult of the fact'[2] to stultify and trivialise psychology's concerns. That my methodology should lead me to sift physiological data is hardly surprising. After all, psychoanalytic theory views motivation as stemming from needs rooted in the biology of the individual. Indeed, any self-sufficient psychological theory must consider psychological action not in isolation but along with underlying biological processes: only in Wonderland can we have the grin without the cat.

2 See Hudson (1972).

## SUMMARY

This thesis investigates the hypothesis that convergent and divergent thinking reflect different defensive preferences - convergers inclining towards repression, divergers to intellectual modes of defence.

To test this claim, individuals' reactions to their own dreams - a rich source of threatening material, according to psychoanalytic theory - were investigated. Utilising all-night electrophysiological monitoring of sleep, recall following awakenings from REM (dream) sleep was contrasted for convergent and divergent groups. The convergers did prove poorer at recalling dream content, but only from those awakenings that, it had been postulated, might elicit threatening material. Convergers' recall of non-threatening material ('control' awakenings) actually proved slightly better than for their divergent counterparts. These findings were taken to support the view that convergers more typically resort to repressive defensive measures.

Comparing REM sleep between the two groups on undisturbed nights, divergers were found to spend more time nightly in this stage of sleep than convergers. In addition, the REM sleep of divergers was characterised by a much lower density of eye movements. A closer analysis revealed that divergers spent much more time in substantial episodes of REM sleep without eye movements.

This finding was taken to reflect a divergent preference for intellectual modes of defence, having previously speculated that, during these episodes without eye movements, secondary revision of threatening dream experience may occur. The lower density of eye movements discharged by divergers was also attributable, in part, to a tendency for convergers to spend more time in episodes of sustained eye movement activity. Moreover, convergers exhibited a longer first period of REM sleep than divergers (against the overall trend) and a shorter REM sleep latency - all of which suggest a greater need for REM sleep and, arguably, its psychological concomitant, dreaming. This pattern was seen as support for psychological compensation, convergers making up for less imaginative day-time experience with more immediate and more intense dreaming.

# PART 1

## CHAPTER 1

### CONVERGENT AND DIVERGENT THINKING AND DEFENSIVE BEHAVIOUR

The tradition of intelligence testing goes back to the pioneering efforts of such men as Binet, Terman and Thorndike during the early years of the present century. This work firmly established the intelligence test as the technique for sorting the bright from the dull, a position it still enjoys today. After this initial burst of innovation, however, progress slackened. The pursuit of more subtle mental tests was abandoned as mental testers became engrossed in the complexities surrounding the factor analytic extraction of the 'structure' of the intellect. One consequence of this involvement was that thoughts turned away from the question of the predictive power of the intelligence test.

This neglect was brought home by Terman's monumental study in which he followed more than fifteen hundred 'gifted' children[1] into adulthood (Terman & Oden, 1947, 1959). Many of his cases, true to form, had successful careers, but many others did not. What appeared to distinguish the successes from the failures was not differences of an intellectual nature, but those of a

1 Those with I.Q.s of 140 or over.

personal or social kind. This inability on the part of 'intelligence' tests to discriminate the successful from the less so has been confirmed in subsequent studies. Future Open Scholars at Oxford and Cambridge, for example, are distinguished from their peers not by their I.Q. ratings but by their tendency to work hard and by their breadth of extracurricular interests (Hudson, 1964). In fact, men of eminence from a variety of walks of life perform no better on these tests than their less successful colleagues (Roe, 1953; MacKinnon, 1962a, 1962b).[2] Indeed, beyond a comparatively moderate level,[3] there appears to be no association whatsoever between intelligence test performance and creative achievement.

This failure on the part of intelligence tests was taken up by Guilford in his presidential address to the American Psychological Society in 1950. What were needed, and what he proposed, were new mental tests that would ensnare the abilities associated with creativity. During succeeding years, Guilford and his associates devised a

2 Interestingly, even as exhaustive an assessment as Final Honours examinations fares no better in the prediction stakes. Tangible success in such widely differing fields as scientific research (as evidenced by FRSs and DScs); politics (Cabinet Ministers versus non-Cabinet Ministers versus backbench MPs); and law (High Court versus County Court Judges) bears little or no relation to class of degree obtained (Hudson, 1958, 1960, 1961).

3 This level appears to be around an I.Q. of 120 (MacKinnon, 1962b).

number of these tests and isolated a number of specific 'creativity' factors - 'fluency' factors, 'flexibility' factors and an 'originality' factor (see e.g., Guilford, 1956, 1959). These factors were seen as sub-processes of 'divergent' thinking - the thought process that Guilford regarded as generating original, creative ideas. In contrast, the more conventional intelligence test tapped the process of 'convergent' thinking - the ability to 'home', or converge, on the single correct answer.

The concept of divergent thinking is best defined in terms of the tests designed to measure the process. Much as with conventional intelligence tests, divergent thinking tasks take many forms, verbal and non-verbal, visual and non-visual. Subjects have been asked to provide as many different meanings of particular everyday words as spring to mind; to come up with as many uses as possible for everyday objects; to think of different titles for a story plot; to describe as many different pictures as they can 'see' in certain patterns; and so on. 'Fluency' is determined by the absolute frequency of responses; 'flexibility' by the number of categories of response; and 'originality' by the number of unique or unusual responses (in a statistical sense). Here, in other words, the individual is invited to think tangentially, to associate in a loose fashion - in short, to diverge.

The next step was to determine whether these divergent thinking tests did, in fact, discriminate the creative from the non-creative. The findings proved disappointing. These so-called 'creativity' tests fared little better than the conventional 'intelligence' tests as indicators of originality in practice (MacKinnon, 1962a, 1962b). Armed with this knowledge, the test critics were not slow on the scene. Referring back to Guilford's own findings (Wilson, et al, 1953, 1954; Guilford et al, 1957), certain commentators (Thorndike, 1963; Ward, 1966) argued that Guilford had failed to demonstrate the separability of his 'creativity' tests from conventional intelligence tests; for the 'creativity' measures enjoyed little variance in common other than that they also shared with intelligence test measures.

This argument seems misplaced. For although many of the earlier studies did find some correspondence between 'creativity' measures and 'intelligence' measures, the heterogeneity of these measures far outweighs their homogeneity. In the three Guilford studies under scrutiny, the average correlation between the two kinds of test measure was +.17. In other words, the two measures share less than 3% of their variance. Clearly, this meagre association will have little bearing on a possible relationship between these 'creativity' tests and actual creative accomplishment. The problem is rather whether the divergent thinking factors share enough variance among themselves to be regarded as measuring anything in common. Taken together, the 'creativity' factors correlated, on average, +.20 in the same three studies. One particular 'creativity' factor, 'fluency', correlated, on average, +.30 across the various tests, and only +.13 with intelligence tests. This is still on the low side by intelligence test standards. But Guilford may have assumed, quite reasonably, that the abilities on which creativity depend are, by their very nature, more diverse and less consistent than those on which formal reasoning depend.[4] There was still reason to hope that some, if not all, of his factors would have predictive powers. As we shall see, they do - if not in the direction Guilford intended. In his own defence, Guilford may at least point out that he did not approach the problem wearing a psychological blindfold, drawing his factors, and thereafter his tests, from statistical data alone. To Guilford, the tests did have face validity; they looked the part.

4. Correlational data may, in any case, have little bearing on the psychological unity of a trait. The various 'creativity' factors may tap alternative, but functionally equivalent, strategies leading to creative accomplishment: in which case, high inter-correlations between the factors should not necessarily be expected. This type of situation has been found in a study of academically successful students. It turned out that, among the most successful, each student was <u>either</u> high in I.Q. <u>or</u> very widely read, <u>or</u> exceptionally hard working, and the inter-correlations between the three variables were effectively nil (Hudson, 1961). This point has been developed by Hudson (1975).

Wallach & Kogan (1965) attributed the relative lack of success in distinguishing 'creativity' and 'intelligence' tests to the conditions and atmosphere in which the tests had been administered. They argued that Guilford had adhered too closely to the conventional testing procedures which were more likely to promote convergent than divergent thinking. As a result, in their study on primary school children, Wallach & Kogan took care to ensure that all the divergent thinking measures were collected in situations designed to minimise 'test anxiety'. They used teachers well-known to the children as 'experimenters' and the tasks were completed during 'games' and 'lessons' without giving any clue to the children that they were being tested. There were five divergent thinking tests in all, each scored for 'fluency' and 'uniqueness'. The tests were given untimed. The average inter-correlation among the ten measures was +.41; among the five 'fluency' measures, +.46; and among the five 'uniqueness' measures, +.43. In contrast, the average correlation between the divergent thinking and intelligence measures was only +.09. As Wallach & Kogan's sample was unselected on general intelligence, these findings are all the more remarkable. Other studies using this non-evaluative test procedure have confirmed the influence of this approach. In a recent study with older schoolchildren (again using an unselected sample), correlations between visual and non-visual 'fluency' measures of +.51 were obtained, and between these measures and an intelligence test (AH5) the correlation was +.10. With a selected (student) sample, the correlation between intelligence test performance and a single verbal 'fluency' test dropped to +.01.[5]

Removing the evaluative context from the administration of divergent thinking tests had effectively neutralised the relationship between these tests and the more conventional type of intelligence test. But it had done much more besides. Without the test aura, many subjects' expression loosened; they felt free to be ambiguous, to compromise, to strain credulity, to be irrational - to diverge, not just in a dry, intellectual way, but in a wealth of personal ways.

## Convergence and Divergence - A Contrast in Style

While these tests of divergent thinking may have failed in their original purpose, they have illuminated the presence of contrasting cognitive 'styles', particularly in individuals of above-average intelligence. For some individuals exhibit a striking bias in their performance on convergent and divergent thinking tests. On the one hand, there is the

5 These findings refer to unpublished data obtained by Margaret Cormack, James McGuire, Peter Sheldrake and myself from samples screened for other experiments at the Research Unit on Intellectual Development in Edinburgh. The school sample numbered 119, the student sample 154.

individual who responds competitively to the rigours of the conventional intelligence test but shies away from the novelty of divergent thinking tests; on the other, the individual who dislikes the uncompromising, restricting approach required by the intelligence test but revels in the freedom of expression encouraged in the divergent thinking tasks.

These contrasting cognitive styles have proved to be enduring characteristics once formed (Povey, 1970); and a substantial body of research now exists linking these intellectual biases with other aspects of an individual's life. Two major studies, in particular, have unearthed a number of more personal characteristics typical of those exhibiting these styles of thinking. The first of these was carried out by Getzels and Jackson (1962) in America; the second, by Hudson (1966, 1968) in England. In both cases, the populations under study were decidedly bright, senior schoolchildren.[6]

6 Getzels and Jackson's findings refer to both boys and girls; Hudson's refer predominantly to boys. Hudson did not find the same consistent link between convergent and divergent thinking bias and more personal attributes among girls that he did with boys. In view of the very different cultural pressures brought to bear on boys and girls, this is hardly surprising. Moreover, there is some evidence to suggest that convergent and divergent thinking bias in girls is influenced by variations in the menstrual cycle (Cormack & Sheldrake, 1974). That Getzels and Jackson's data allowed them to treat the two sexes together may be explained, at least in part, by differences in treatment of boys and girls in America and England.

Getzels and Jackson referred to those subjects exhibiting a bias toward convergent thinking as 'high I.Q.s' and those exhibiting a divergent thinking bias as 'high creatives'; Hudson, more simply, as 'convergers' and 'divergers', respectively - the terminology to be adopted here.

One of the most striking differences encountered between convergers and divergers is in the attitudes and values they display. Getzels and Jackson found that, while both groups agree as to the qualities favoured by their teachers, only convergers incorporate these values in their 'self ideals'. Divergers, on the other hand, develop their own values showing a quite remarkable disregard for those of their teachers.[7] Hudson (1968) also found that divergers are less likely to acquiesce when confronted with the opinion of an authority figure. Getzels and Jackson suggest that this independence on the part of divergers reflects their 'internal locus of evaluation'.[8] But there may also be an element of perversity in their separate stance. For the qualities

7 For example, convergers stress the importance of conventions such as 'high marks', 'high I.Q', and 'goal directedness'; divergers set more store by a sense of humour.

8 If this were the case, one would expect to find that divergers are more introverted than convergers. In fact, no difference has been found between the two groups on the Maudsley Personality Inventory (Hudson, 1968).

divergers preferred for themselves actually correlated negatively (-.25) with the qualities believed favoured by their teachers (Getzels and Jackson, 1962). Moreover, Hudson (1968) reported that divergers hold a rather antagonistic view of authority figures. When faced with an 'authority situation', vaguely depicted, and allowed to put their own interpretation on the scene, divergers proved more likely than convergers to see the authority figure as menacing. Teachers, too, may sense this. Certainly, Getzels and Jackson's divergers were less liked by their teachers than were their convergers, although both groups excelled at scholastic work.

In response to a 'Personal Qualities Questionnaire', Hudson (1966) found that convergers express authoritarian, socially conforming and rigid attitudes more frequently than divergers. Convergers are more likely to approve of being obedient, and of having a low opinion of themselves; and to disapprove of being independent of their parents. They are also more likely to approve of mixing well socially, of being a good team member, of being personally neat and tidy, and of being very well-mannered; and to disapprove of 'arty' clothes, and bad language. And they are more likely to approve of accepting expert advice, and having set opinions; and to disapprove of being highly imaginative and of artistic sensitivity.

Hudson also found consistent differences in response to controversial statements: convergers again expressing more conservative, conforming tastes; divergers' tone being more liberal and non-authoritarian. For example, divergers are more likely to favour freedom of choice in reading; and to show hostility toward apartheid, Boy Scouts and the Combined Cadet Force. Divergers also proved more likely to adopt minority attitudes - a factor that may have had a considerable bearing on their responses. In other words, once again, divergers' choice may have been dictated by a desire to be perverse, to discomfort others.[9] This may well explain the puzzling contradictions encountered in the divergers' responses. For the divergers' liberalism broke down in a most alarming way, with the majority of them supporting caning at school and fox hunting. The latter seems particularly perplexing as, elsewhere, they approve strongly of 'fondness for animals', more so than the convergers.[10]

9 Interestingly, one of the few items on the Extraversion Scale of the Maudsley Personality Inventory to discriminate between convergers and divergers was, "Do you like to play pranks upon others?": divergers were more likely to reply in the affirmative (Hudson, 1968).

10 In this connection, Getzels and Jackson note that divergers are more likely to express an interest in a veterinary career.

Turning to the test material, the open-ended tasks[11] discriminate in a host of ways between convergers and divergers. Both Getzels and Jackson and Hudson report a very similar pattern of response. Convergers' responses have been variously described as factual, specific, rational, precise, serious, impersonal, unimaginative, 'stimulus-bound', and so on. Divergers' responses, on the other hand, are non-specific, playful, humorous, ambiguous, personal and emotional, imaginative, 'stimulus-free', and violent. Convergers' responses seem superficial and aloof; divergers seem to put personal meaning into theirs. Convergers persist with one theme, often resorting to detailed analysis; divergers flit from one theme to another, without pause for analysis or reflection. Convergers seem less willing to risk the possibility of error, or of being misunderstood; divergers seem more willing to leave something to the imagination of others. Convergers show more interest in things than in people; divergers, people rather than things.

One further point seems worthy of mention. Convergers have shown themselves to be quite capable of producing more imaginative, personal material in certain

11 The term adopted by Hudson. 'Creativity' test seems hardly appropriate in view of the test's failure to predict in this area. 'Divergent thinking' test is also rather misleading since the convergent/divergent distinction rests on a bias between the two types of test, not on the open-ended tests alone. In fact, Hudson (1968) demonstrated that bias is more than twice as discriminative of arts/science differences (see below ) than open-ended test scores.

circumstances. In one study, Hudson (1968) changed the presentation of the 'Uses of Objects' test. On this occasion, instead of open-ended instructions, the test <u>required</u> ten responses for each item and also gave examples of the breadth of possible responses. In this situation, convergers produce responses of a much more divergent nature. Hudson devised a second experiment that also draws out this latent capacity. Convergers were asked to tackle a 'Uses of Objects' test as if they were an 'an uninhibited, rather bohemian figure' who 'often says things for effect, and likes to shock people with coarse or gruesome jokes'. Donning this mantle, convergers once again produced a far richer array of responses than seemed possible from their previous attempts. One further piece of evidence, from Getzels and Jackson's study, illustrates the same process. In respect of their career aspirations, convergers are much less likely than divergers to offer unconventional choices. However, when Getzels and Jackson employed a projective technique - which involved asking their subjects to attribute career choices to others - convergers' unconventional choices increased and, statistically, the difference between the two groups disappeared. Each of these strands of evidence, in drawing attention to the convergers' ability to respond in a fashion typical of the diverger, serves to highlight the restraint normally imposed by those who think in a convergent manner. Apparently, convergers' expression loosens only when responsibility for their responses does not fall on <u>them themselves</u>; when <u>their</u> choice is not reflected.

The characteristic open-ended test responses of the converger, in particular, led Getzels and Jackson to conclude that convergent thinking is one manifestation of a more general defensive disposition. Divergent thinking, in contrast, was taken to reflect essentially an 'openness' to experience, a relatively non-defensive orientation. Hudson (1966), on the other hand, sees both biases as defensive in nature; for the almost compulsive 'openness' displayed by divergers has a hollow ring to it. What differs rather are the defensive strategies typically employed by the two groups: convergers resorting to inhibition or repression; divergers more to intellectualisation. On this interpretation, convergers' unwillingness to enter into the spirit of open-ended tests is seen as one symptom of a more general inhibition in tackling the non-rational aspects of life, notably those of an emotional, personal nature; and the divergers' 'open' verbal fluency as a deception, cloaking a more subtle censorship.

Hudson (1966) has also drawn attention to the close association between convergence and divergence on the one hand and academic specialisation on the other. In his population of English schoolboys, physical science specialists were much more likely to be convergent and arts specialists to be divergent.[12] This in itself seems to contest the view that open-ended tests measure creativity. It also raises problems for an explanation of convergent and divergent thinking revolving round deep-rooted defensive structures. For convergent and divergent thinking may be the result of academic specialisation - a superficial adoption of the 'mores' of the respective disciplines. Alternatively, and in keeping with the defence hypothesis, the possession of a convergent or divergent personality may be a predisposing factor underlying an individual's subsequent choice of subject. The little information we have bearing on this question favours the notion that the ontogeny of convergence/divergence does precede academic specialisation. One major study, employing ten and eleven year olds, demonstrated the presence of convergent and divergent thinking at this age (Wallach & Kogan, 1965). Recently, it has been suggested that the precursors of convergent and divergent intellectual bias may be present as early as the pre-school child (Hutt & Bhavnani, 1972). Three to five year olds, categorised according to their

12 As American schoolchildren do not specialise to the same extent, Getzels and Jackson were unable to make a similar comparison. However, they did find differences in the career aspirations of convergers and divergers that support Hudson's findings. For example, convergers were more likely to plump for engineering and architecture, and science; divergers for writing, art, entertaining and dancing.

responses to a new toy, were followed up and retested for open-ended test performance some four years later. The investigators found that overt exploratory behaviour rated for imaginativeness at the pre-school stage was an excellent predictor of subsequent open-ended test performance, particularly with boys. Unfortunately, there is no mention of intelligence tests being administered to the children, and it may be that what was measured was no more than a difference between bright and dull children.

Whatever the age at which convergent and divergent thinking biases first emerge, it would seem to precede academic specialisation. Nevertheless, it is still likely that academic traditions and style acquired after specialisation sharpen any differences already present. In support of this assertion, Hudson (1966) found that arts and science specialists, as groups, become increasingly divergent and convergent respectively with the passage of time.[13]

If, as the main investigators have proposed, the convergent/divergent distinction reflects differences of a deep rooted nature, then this link between academic discipline and convergence/divergence raises more problems than it solves. What of the individual who finds himself

13 It is worth noting that this was not 'longditudinal' evidence from the same individuals. This effect may result from 'misfit' individuals switching subjects rather than their yielding to academic influence.

in the 'wrong' academic environment - the converger surrounded by artists; the diverger in the austere world of the scientist? Do these 'misfits' yield to the pressure exerted by their academic milieu? And if they do, is this yielding anything more than the forming of a 'crust' - a superficial response repertoire that to some extent mimics an academic style but is not 'driven' by the individual's underlying personality? If individuals do yield in this superficial way, what effect does this have on their defences? In order to preserve their self-identity, do misfit convergers and divergers actually intensify their defensive orientation in this situation? If 'misfits' display an extreme convergent/divergent bias relative to their academic group but only a mild bias relative to the academic community as a whole, are we to regard them as mild or extreme convergers/divergers in the wider sense of personality? Finally, do convergers and divergers react in similar ways to this dilemma? We have little evidence to guide us. Yet these are problems of utmost importance, and ones that will be touched upon in the present study. Unfortunately, this was only of tangential concern here, but even in this brief encounter, these 'misfits' left the author with a very real sense of their conflict.

## Convergence and Divergence - A Developmental Model

Hudson (1972) has incorporated this link between cognitive style and academic specialisation, and more particularly the defensive styles that convergers and divergers appear to display, within a developmental framework. He has suggested that convergers and divergers' personalities 'gel' or 'fixate' at different stages during the course of development. Convergers fixate early, during the 'latency' period, a time of conscious preoccupation with the acquisition of impersonal skills - with ideas, symbols, and abstractions rather than people - aided and abetted by the rigorous control of infantile, emotional impulses. Divergers, in contrast, fixate later, during adolescence, at which time the teenager once again grapples with the emotional turbulence that has been repressed since infancy. Rather than directly expressing these emotions, as in infancy, the adolescent resorts to symbolic re-creation and, in so doing, intellectualises his raw drives. Certainly, the converger/scientist's attention to detail, his concern with accuracy, bears more than a passing resemblance to the pre-adolescent child; in contrast, the divergent/arts style seems the very antithesis, reflecting more the reckless rhetoric of the adolescent.

The model accounts rather nicely for Hudson's observation (1968) that, whereas the stereotype of the scientist is already present in the pre-adolescent child, the stereotype of the arts specialist takes shape later, during adolescence.[14] For the stereotypic scientist embodies the value system prevailing during the latency period, whereas the arts figure must appear quite unintelligible to the pre-adolescent child; his comprehension of this stereotype must await adolescence and his renewed acquaintance with the personal and emotional.

The fixation hypothesis generates certain other predictions that fit available evidence. Certainly, scientists do appear to avoid interpersonal contacts (McClelland, 1956; Cattell & Drevdahl, 1955) and, moreover, this lack of sociability was already present among ten year olds who subsequently became scientists (Terman, 1954). Budding scientists also commit themselves to science at a younger age than arts specialists commit themselves to the arts (Lunt, 1967; Butler, 1968). More generally, Getzels and Jackson found that adolescent convergers had already made a career choice, or at least had narrowed the field.

14 The typical scientist was seen as intelligent, valuable and dependable, but dull and unimaginative; the arts specialist as warm, exciting and imaginative, but relatively unintelligent, undependable and lacking in value. The stereotype of the scientist was already present in the youngest sample tested (11 year olds); the arts stereotype only gradually crystallised with successively older samples of schoolboys.

Divergers' career aspirations, on the other hand, were less settled, often including unresolved combinations such as 'law or music'. When convergers and divergers are asked to rate themselves on certain aspects of Self, Hudson (1968) found that convergers are much less likely than divergers to differentiate between either their 'Actual' Self (who they actually were) or their 'Perceived' Self (who their teachers took them to be) on the one hand and their 'Future' Self on the other. As Hudson indicated:

> "This suggests that by the age of fifteen or sixteen, convergers are much more settled than divergers about the kind of person they expect to become." (p.58).

Also congruent with the fixation hypothesis, is the idea that convergers sublimate 'aggressive' energies whereas divergers sublimate impulses of a 'sexual' nature (Hudson, 1973). If convergent and divergent thinking are indeed 'driven' by these different sublimated energies, convergers should be less inclined to 'act out' aggressive drives directly and divergers should avoid 'acting out' drives in the sexual sphere.

Tentatively, certain strands of evidence do point in this direction. Tangential support has come from the suggestion that physical scientists avoid open aggressiveness (McClelland, 1962), largely on the basis of their responses to TAT cards (Roe, 1951; Knapp, 1956). In an intriguing study, McClelland (1962) asked science and non-science specialists to rate a list of metaphors in terms of how well they described nature. Although the study had a different purpose in mind, it is interesting to note that each of the six metaphors least liked by the scientists (relative to the non-scientists) contained themes of aggression or uncontrolled power. In contrast, none of the eleven metaphors liked best by the scientists (again in relation to the non-science group) were particularly aggressive in tone.[15] Getzels and Jackson (1962) reported that convergers were less likely than divergers to introduce violence into their stories (from TAT cards) and drawings. Hudson (1966) also found that convergers offered fewer uses of objects and drawings involving personal violence than divergers, although those they did express were frequently particularly gruesome. The very strength of these convergent aggressive outbursts that do find expression suggests that convergers exert control in this direction.

15 The six metaphors least liked by scientists were: the desolations of many generations; a tyrant despite her lovely face; a great cave that encompasses us and swallows us up like atoms; a spring whose waters will not do our bidding; a Titan waiting terribly to break forth; an arrogant master who likes to rule and dominate. None of these metaphors was in fact ranked higher than 50th (out of 59) on average by scientists. The eleven metaphors liked best by the scientists were: a pillar of strength and virility; a perfect woman nobly planned; the nurse, the guide, the guardian of my heart and soul; a grand and inspiring father; lady of silences; a banquet of delights; a stern and loveless master; glens of brightness; a vineyard to be reaped for pleasure; something certain and infinite; and fairest among women.

On the reverse side of the coin - and again suggestive but no more - young husbands who see themselves as divergent report a lower investment in 'a fulfilling sex life' and a lower rate of orgasm than young husbands who see themselves as convergent (Hudson et al, 1973). Less direct evidence comes from two studies of the personal lives of arts and science specialists. Eminent arts specialists proved nearly five times as likely to remain single; and even if they did marry, they were more likely to remain childless (Hudson & Jacot, 1971).[16] A subsequent large scale study of American academics also found that arts specialists are more likely than scientists to remain single and childless (Hudson, 1973). Finally, McClelland's metaphor study is also of some interest here. For a considerable proportion of the metaphors most preferred on a relative basis by the scientists (and therefore least preferred by the non-scientists) have a decidedly sexual flavour. Had the non-science group been restricted to arts specialists (it also contained social scientists), this trend may have proved more marked.

16 This sample, 692 in all, drawn from Who's Who, were all born between 1900 and 1925 and, at the time of the study (1969), averaged 57 years. Hence, most of their lives preceded the advent of the contraceptive pill.

To take one further retrospective (and speculative) step, how might this suggested difference in age of fixation occur? Particularly in early childhood, attitudes are influenced predominantly by parental values, usually the mother's with whom the child has more contact at this stage. It is not surprising, therefore, to discover that mothers of convergent schoolchildren stress the importance of 'external' characteristics such as 'studious' and 'well-mannered' behaviour, whereas mothers of divergers emphasise 'internal' characteristics, notably 'openness to experience', a 'sense of values', and 'enthusiasm for life' (Getzels and Jackson, 1962). Moreover, the convergent mothers themselves appear to have had an upbringing that stressed external, material values. It would seem that convergers and divergers are products of, respectively, like-minded mothers. As a result, the unfolding converger and diverger are likely to experience very different pressures.

In the converger's case, although his mother is likely to make some pretence, at an overt level, of expressing feelings of warmth and affection towards her child, this expression (which is foreign to her nature) may contrast sharply with her more covert communication. This 'double talk' places the child in what has been called a 'double bind' dilemma (e.g., Bateson _et al_, 1956). The situation may become further aggravated, if, as a reaction to the embarrassment the child has caused her, the mother becomes critical.[17] To avoid the discomfort of this dilemma, the child of the converger is driven to inhibit the personal, apparently alarming, side of his nature as soon as the initial emotional dependence of infancy is outgrown. This resolution is met with parental relief, and further reinforced by active encouragement of impersonal pursuits. To the child of the converger, the impersonal world becomes a sanctuary from the threat of emotions, leading to an early and strong commitment to these impersonal ideals, and one not easily shifted even by adolescent upheaval.

While the course open to the child of the converger is relatively clear, that of the future diverger is less so. If the divergent child encounters 'double talk' it is probably in his mother's communication concerning his practical accomplishments. At the same time, maternal response to his emotional advances is unequivocal, pressuring him to cling to infantile emotional dependence and delaying his transition to the latent stage of development. Eventually, the constraints of schooling force the unfolding diverger to take up more impersonal matters. But his commitment to the factual world is not the dynamic one of the converger; and the diverger will

17 Apparently a more common reaction among the mothers of convergers than the mothers of divergers (Getzels and Jackson, 1962).

return to his earlier emotional world with the broadening of his educational horizons and cushioned by an increasing symbolic sophistication.

It seems, then, that what little we do know about the early influences bearing on the future converger and diverger do suit the model. And there is a growing body of evidence - much of it, admittedly, oblique - with which to succour it. Yet the theme central to the model - the presence of different defensive orientations in convergers and divergers - rests on evidence that goes little beyond the anecdotal. Standing on its own, the convergers' apparent inhibition on open-ended tests may merely reflect an antipathetic reaction to tests of an 'unscientific' kind; and, similarly, divergent fluency may be uncomplicated by any defensive motivation. If we can confirm this central theme, not only will we promote Hudson's developmental model but we will also answer the more pressing question of whether convergent and divergent thinking do indeed reflect differences of a deep-rooted nature. It is the aim of the present investigation to place this suggestion of a link between convergence/divergence and defensive orientation on a more experimental footing.

Typically, experimental scrutiny of ego-defence mechanisms has involved presenting 'standard' stimuli to 'unsuspecting' subjects in the fond hope that they will react in some specified way to the supposedly threatening items. Such an approach ignores individual differences in what is perceived as threatening. More natural, surely, to study the individual's reactions to his own psychic experience. One such personal source, and a particularly rich one, is dreaming.

# CHAPTER 2

## SLEEP, DREAMING AND DEFENSIVE BEHAVIOUR

Freud (1954) was the first to emphasise the role of dreams as a vehicle for the expression of unconscious 'wishes'. These unconscious wishes - which he termed the 'dream-thoughts' - are the real instigators of the dream, and the dream content reflects the fulfilment of these wishes. But we do not experience these dream-thoughts directly; they are disguised. This is necessary, Freud argued, for the reason that they are unacceptable to the conscious, socialised mind. Even asleep, the direct expression of these dream-thoughts would prove too anxiety-provoking. Instead, in response to the 'endopsychic censorship' imposed by resistance, the emotionally-charged dream-thoughts undergo a process of distortion before gaining admission to the perceptual world of the sleeper. This distortion is the product of the 'dream-work' - achieved by means of two processes, 'condensation' and 'displacement'. According to Freud:

> "Dream-displacement and dream-condensation are the two governing factors to whose activity we may in essence ascribe the form assumed by dreams." (1954, p. 308).

Condensation refers to the combination of a number of dream thoughts in a single entity in the manifest dream content; displacement, to the substitution of one idea, affect attribute, person or object for another. A more general type of displacement, that of <u>form</u> of expression, also takes place, which usually results in 'a colourless and abstract expression in the dream thoughts being exchanged for a pictorial and concrete one'.[1] In constructing the manifest form of the dream, the dream-work makes use of 'day residues' (recent waking experiences). Finally, to complete the disguise, a process of symbolisation is adopted, allowing neutral objects to stand for ones that might pose a threat in the context of the dream. In this way the anxiety-provoking nature of the dream, as manifestly expressed, is removed or lessened, allowing the dream to fulfil its function of airing these potentially threatening wishes without disturbing the dreamer's sleep.

Despite the pains taken to disguise the underlying dream-thoughts, the manifest dream may, nevertheless, still provoke anxiety. For the ego's sensitivities, if diminished during sleep, are never entirely lost. Sometimes, for example, so much anxiety is provoked that the dreamer awakes and the dream has failed to fulfil its function as the 'guardian' of sleep. More often, according to Freud, (and of particular concern here) the dreamer handles the anxiety provoked by his dreaming in one of two ways - either by repressing the manifest content

1 Freud, 1954 (p. 339).

altogether or by resorting to 'secondary revision'. Repression refers to the expulsion of the dream from consciousness after experiencing it.[2] Secondary revision refers to the intervention of our waking thoughts and is not part of the dream thoughts.[3] It takes the form of qualifying comments, interpretations and so on, interpolated or added to the product of the dream-work. Freud has this to say about the secondary revision of the dream-work:

> "When the dream has come into consciousness, we treat it exactly the same way that we treat any content of perception; we try to fill in the gaps; we add connecting links, and often we let ourselves in for serious misunderstanding." (1949, p. 33).

In other words, secondary revision may modify dream experience and, in so doing, serve a defensive function. One can censor as effectively by addition as substraction. The effect of putting one interpretation on an experience is to obscure an alternative, less palatable, interpretation.

2 Freud distinguished between primal repression (barring the conscious expression of a thought in the first place) and secondary repression (expelling the thought from the conscious after experiencing it). Repression of dreams, as discussed in the present context, always refers to secondary repression.

3 In The Interpretation of Dreams (1954), Freud speaks of secondary revision as part of the dream-work, but later (1949) he abandoned this idea.

These two methods of defending against the manifest dream are not mutually exclusive (one may presumably attempt to revise a dream and subsequently repress it) but it is my thesis that <u>convergers will be more likely to invoke repression and divergers to resort to secondary revision when confronted with dreams of a threatening, inadequately disguised, nature.</u> If we can establish this, we not only give substance to the suggestion that convergers and divergers adopt different defensive strategies, but also place the activities of repression and secondary revision of manifest dream content - neither of which enjoy widespread acceptance - on a more secure footing.[4] Unfortunately, a satisfactory methodological precedent with which to test our hypothesis is not to hand. In the case of the repression of dreams, we do at least have a number of previous studies on which to build; but in the case of secondary revision, there is little to guide us. Let us review the developments in the study of dream repression along with further developments in the study of sleep and dreaming, in the hope that these will provide us with sufficient pointers to secure a discriminating line of experimental attack.

4 This argument, of course, is circular since the verification of either depends on the other.

Repression and Home Dream Recall

For long, the only evidence in support of the repression of dreams was of a clinical, anecdotal nature - the apparent retrieval of dreams under certain conditions, such as psycho-analysis, after what appears to be a 'working through of the resistance'. More recent attempts to support the repression of dreams revolve round investigations of individual differences in dream recall. Groups of 'recallers' and 'non-recallers' of dreams have been identified using questionnaires or dream diaries. The questionnaire method merely requires the subject to gauge how frequently he recalls dreaming, whereas keeping a dream diary involves reproducing any dream experience recalled on arousal as a daily exercise, usually lasting several weeks. Using the questionnaire approach, significant correlations have been obtained (Tart, 1962; Domhoff & Gerson, 1967), although not invariably (Cohen, 1969; Bone _et al_, 1970), between personality tests deemed to measure repression and non-recall of dreams. One likely source of inconsistency arising out of the questionnaire design has been highlighted by the finding that 'non-recallers' of dreams on this index frequently become recallers when asked to keep a dream diary (Cohen, 1969) or when woken from sleep (Lewis _et al_, 1966). Despite this objection, classifying recallers and non-recallers on the basis of dream diaries has fared no better. While one such study demonstrated a relationship between an objective measure of repression and failure to recall dreams (Singer & Schonbar, 1961), others have not (Cohen, 1969; Tanck & Robbins, 1970).[5]

Both questionnaire and dream diary designs suffer a major methodological shortcoming as means of observing the effects of repression - namely the lapse in time between experiencing the dream and being called upon to recall it. This lapse is usually considerable, sufficient, at any rate, to allow non-motivated forgetting to occur. Observations of individual differences in dream recall may merely reflect variations in the amount and intensity of dreams experienced or the interest taken in them. It seems scarcely necessary to invoke repression in explanation. Moreover, if the majority of dream forgetting is non-motivated (and the evidence from electrophysiological studies, to be discussed shortly, overwhelmingly supports this), then any evidence that might be taken to support repression will be submerged. In view of this it is hardly surprising that, even in the successful studies, very little of the variance along the recall dimension can be attributed to repression (Domhoff & Gerson, 1967).

5 It is perhaps noteworthy that the studies supporting the action of repression on dream recall (i.e., Singer & Schonbar, 1961; Tart, 1962; Domhoff & Gerson, 1967) all used the Welsh Repression Scale (Welsh & Dahlstrom, 1956); none of the studies reporting negative findings did.

Clearly, then, any experimental design that permits an appreciable lapse in time between experiencing the dream and its subsequent recall is an unsuitable procedure for measuring the effects of repression. To meet this objection, it would be necessary to wake the sleeper during a dream and elicit a recall attempt. On the long-held assumption that dreaming does not occur throughout sleep, such an experiment must embody a means of recognising dream sleep. Fortunately, with the development of electrophysiological recording techniques, just such an experiment can now be undertaken. For dreaming has been associated with a particular pattern of recording. Let us consider, in some detail, the research surrounding this discovery.

## The Sleep Cycle

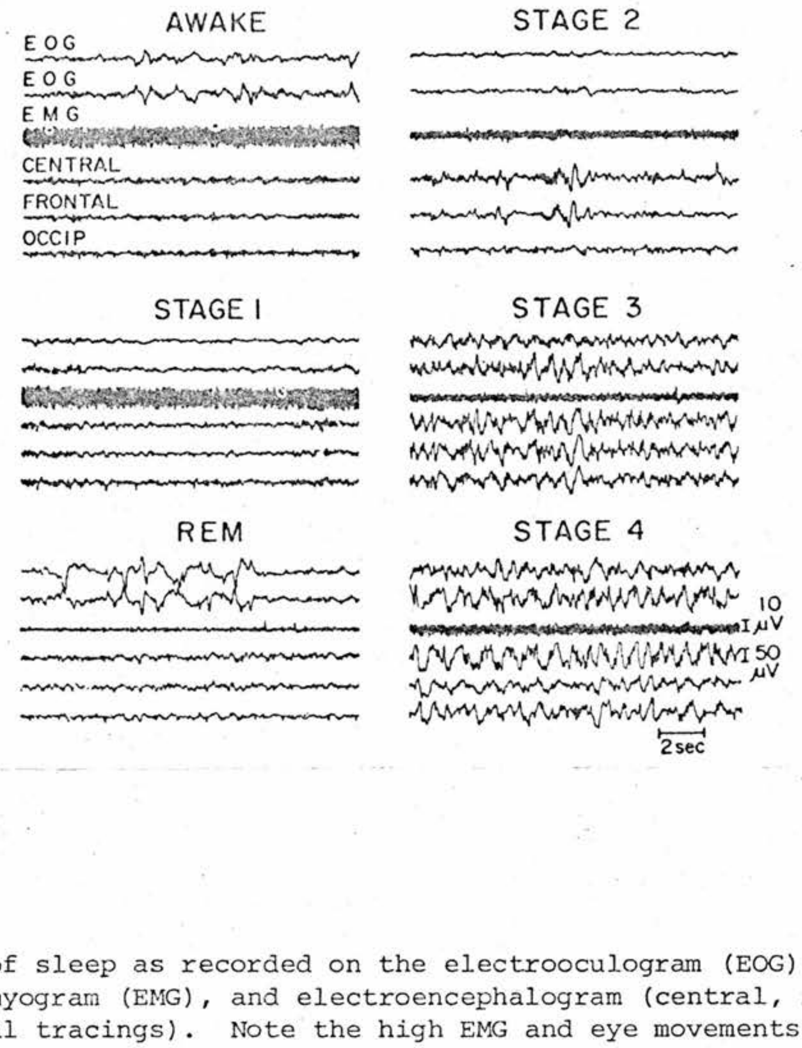
The development of the electroencephalogram (EEG) by Berger in 1929 led to its application in characterising different levels of sleep by Loomis and his associates (1937). They classified the EEG patterns that accompany the passage from wakefulness to sleep into five types, A to E. This classification was widely adopted until Aserinsky & Kleitman (1953, 1955) noted the occurrence of a particular type of eye movement activity - 'rapid, jerky and binocularly symmetrical' - during periods of low-voltage EEG activity. Dement & Kleitman (1957a), on the basis of a large number of subsequent all-night recordings of undisturbed sleep, defined five EEG stages of sleep : stages 1 to 4, during which rapid eye movements (REMs) are absent, referred to collectively as non-rapid eye movement (NREM) sleep; and a fifth stage, REM sleep, which is accompanied by rapid eye movement activity.

Figure 2.1 shows the electroencephalographic patterns in the EEG, eye movement in the electrooculograph (EOG), and muscle tonus in the electromyograph (EMG) which accompany wakefulness and the different stages of sleep. During relaxed wakefulness the EEG is composed of sinusoidal alpha activity (8-12 cps) and low voltage activity of mixed frequency, accompanied by eye movements, eye blinks and a high muscle tone. As the subject falls asleep, his muscles relax and his eyes begin to roll slowly from side to side, while his EEG gives way to a stage 1 pattern of relatively low voltage and mixed frequency. Stage 2 is characterised by 12 to 14 cps sleep 'spindles', similar in shape to alpha waves but higher in frequency, together with 'K complexes'[6] superimposed on a background of relatively low voltage and mixed frequency EEG activity. Stages 3 and 4 are

6 K complexes are relatively high amplitude waveforms exceeding 0.5 secs. in duration, of complex shape - usually a well-delineated, negative, sharp wave immediately followed by a positive component and often, in turn, by sleep spindles. They can occur as a response to an external stimulus but also occur spontaneously (Johnson & Karpan, 1968).

FIGURE 2.1

POLYGRAPHIC RECORDINGS OF THE DIFFERENT STAGES OF SLEEP




Stages of sleep as recorded on the electrooculogram (EOG), chin electromyogram (EMG), and electroencephalogram (central, frontal occipital tracings). Note the high EMG and eye movements during wakefulness, compared with the low EMG and rapid eye movements (REMs) during REM sleep. The EEG is similar during stage 1 and REM sleep, but the EMG is high and REMs are absent in stage 1. Stages 2, 3 and 4 are characterised by slowing of frequency and increase in amplitude of the EEG. (From Berger, 1969).

defined by high voltage, slow waves of 1 to 2 cps; when more than half the record consists of this slow-wave activity, it is classified as stage 4, while lesser amounts (but greater than 20%) are classified as stage 3. REM sleep, while displaying a swift, pinched EEG scrawl similar to that of waking, is characterised by a low muscle tone (Berger, 1961; Jacobson _et al_, 1964) as well as spasmodic bursts of eye movement activity.[7]

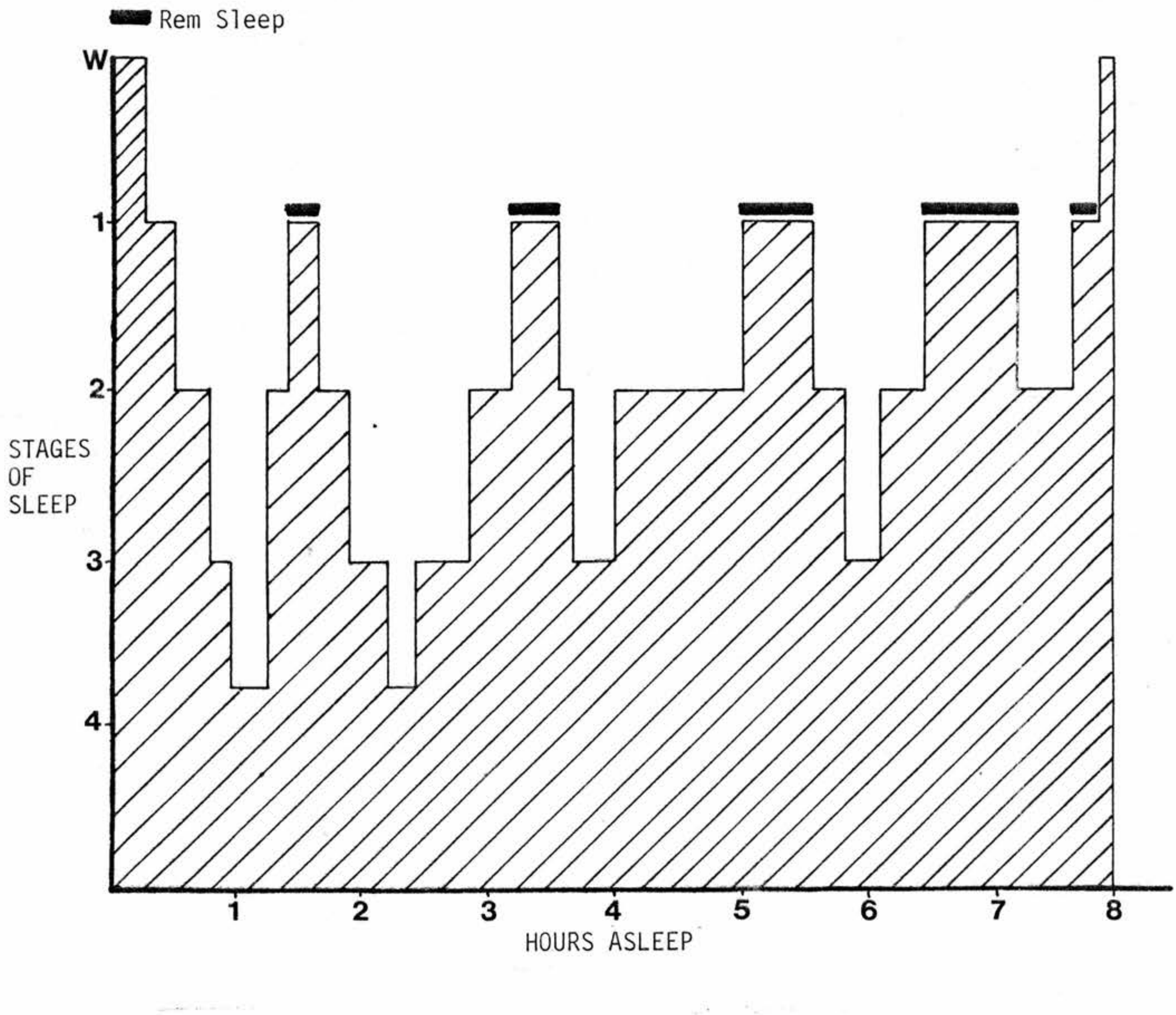
The typical distribution of the different stages of sleep over the course of the night has been mapped in a number of studies with young adults (Dement & Kleitman, 1957a; Rechtschaffen & Verdone, 1964; Williams _et al_, 1964, 1966; Roffwarg _et al_, 1966; Feinberg _et al_, 1967; Kales _et al_, 1967a). The consistent findings are

7 A number of other physiological changes have also been linked to a shift from non-REM to REM sleep: heart and respiration rates, and systolic blood pressure have all been found to increase (Aserinsky & Kleitman, 1953; Snyder _et al_, 1964), and particularly their variability (Jouvet _et al_, 1960; Snyder _et al_, 1963, 1964; Shapiro _et al_, 1964); rate of neutral discharge throughout the sensory and motor areas of the brain increases to levels similar to those found during active arousal (Huttenlocher, 1961; Evarts, 1962, 1964; Arduini _et al_, 1963), along with an increase in cerebral blood flow (Kanzow _et al_, 1962; Reivich _et al_, 1968), brain temperature (Kawamura & Sawyer, 1965), and brain oxygen consumption (Brebbia & Altshuler, 1965; Kety, 1967); and penile erections most frequently coincide with periods of REM sleep (Fisher _et al_, 1965; Karacan _et al_, 1966).

represented in Figure 2.2. The initial descending stage 1 EEG of sleep is usually followed by stages 2, 3 and 4 in that order. After about seventy minutes, of predominantly stages 3 and 4 non-REM sleep, the first REM (ascending stage 1) period occurs. It is usually heralded by a series of body movements and a shift in the EEG to a stage 2 pattern. The first period of REM sleep tends to be brief and 'broken' (interspersed with stage 2 EEG features) and is sometimes 'missed'-although sleep lightens to a stage 2 pattern, the EEG reverts to stage 3 or 4 after a few minutes, with REM sleep making its first appearance at the time of the usual second REM period. From the third cycle of the night, stage 4 is rarely seen and toward morning the cyclic alternation may simply be between stage 2 and REM sleep. The later periods of REM sleep are usually lengthier and, in terms of the profusion of eye movements, more intense (Foulkes, 1966). The REM-NREM sleep cycle averages seventy to ninety minutes in length and is repeated four to six times throughout the night, depending on the total length of sleep. Roughly twenty to twenty-five percent of the total sleep time of young adults is spent in REM sleep, five percent in stage 1, as much as fifty percent in stage 2, and twenty percent in stages 3 and 4 combined. The pattern of sleep from night to night in a single individual remains relatively constant, except for the first night spent in the laboratory when the subject takes longer to fall asleep, tends to awaken spontaneously more frequently,

FIGURE 2.2

A TYPICAL NIGHT OF SLEEP IN A YOUNG ADULT




Distribution of sleep stages over the course of the night. REM sleep occurs periodically throughout the night, and increasingly toward morning. Individual periods of REM sleep may vary in length from a few minutes to an hour or more, and tend to be longer in the latter half of the night.

and has less REM sleep than on subsequent nights (Dement _et al_, 1965; Agnew _et al_, 1966). This has been referred to as the 'first night effect' and undoubtedly represents the effects of adaptation to sleeping with electrodes attached in the unusual environment of a research laboratory.

## The Relation between Dreaming and the Sleep Cycle

Prior to the discovery of REM sleep, there had been a number of studies undertaken to determine whether dreaming was associated with a particular stage of sleep as recorded on the EEG. Considered together, the results of these early studies suggested that dreams could be recalled following awakening from any stage of sleep (Blake _et al_, 1939; Davis _et al_, 1938; Teplitz, 1943). The cyclic recurrence of REMs, together with an activated pattern in the EEG somewhat similar to that of wakefulness, caused Aserinsky & Kleitman (1953, 1955) to ponder on whether this unique sleep state was the one in which dreaming occurred. To test this hypothesis, they subsequently awakened subjects after intervals of sleep with and without these eye movements. This resulted in:

> "Of 27 interrogations during ocular motility (REMs), 20 revealed detailed dreams usually involving visual imagery; the replies to the remaining 7 queries included complete failure of recall or else 'the feeling of having dreamed', but with inability to recollect any detail of the dream. Of 23 interrogations during ocular inactivity, 19 disclosed complete failure of recall, while the remaining 4 were evenly divided into the other 2 categories." (1953, pp. 273-4).

Aserinsky & Kleitman concluded that:

> "Although no attempt was made to secure a thorough account of the recalled events during the extremely brief interrogation, there were reports revealing strikingly vivid visual imagery, especially after the subjects were awakened following the eye movements. It is indeed highly probable that the rapid eye movements are directly associated with visual imagery in dreaming." (1955, p.9).

The high incidence of recall following awakenings from REM sleep has been confirmed in a host of subsequent studies (Table 2.1). However, for NREM awakenings there has been less consistency among investigations of dream recall, reported frequencies ranging from 0 to 74%. This wide range appears to be a function of the differing criteria used to define what mental experience constitutes a dream. If the definition includes a verbal report of an experience involving vivid imagery, frequently of a bizarre or unreal nature, in which the dreamer may be actively involved, then the 7% NREM recall rate originally obtained has been confirmed by most investigators. However, if a broader category of cognitive activities is used in defining a dream, including fragmentary reports of mental phenomena that may lack sensory imagery and seem closer to everyday thinking, then figures as high as 74% have been obtained.

TABLE 2.1: PERCENTAGE RECALL OF DREAMS FOLLOWING REM AND NREM AWAKENINGS

| | Study | No. of Subjs. | Total no. of Awakenings | Criteria of Dream Recall | REM | NREM |
|---|---|---|---|---|---|---|
| 1. | Aserinsky & Kleitman (1955) | 10 | 50 | Definite recall of dream content; detailed dream description. | 74 | 7 |
| 2. | Dement (1955) | 10 | 70 | Vivid recall of content. | 88 | 0 |
| 3. | Dement & Kleitman (1957b) | 9 | 351 | Coherent, fairly detailed description of dream content. | 79 | 7 |
| 4. | Wolpert & Trosman (1958) | 10 | 91 | Detailed recall of complete drama. | 85 | 0 |
| 5. | Goodenough _et al_ (1959) | 16 | 190 | Content recalled in some detail. | 69 | 34 |
| 6. | Jouvet _et al_ (1960) | 4 | 50 | Not specified. | 60 | 3 |
| 7. | Snyder (1960) | 16 | 237 | Content recalled in some detail. | 62 | 13 |
| 8. | Wolpert (1960) | 8 | 88 | Not specified. | 85 | 24 |
| 9. | Kremen (1961) | 9 | 57 | Subjective impression of having dreamt regardless of content recall. | 75 | 12 |
| 10. | Foulkes (1962) | 8 | 244 | Any specific content. | 87 | 74 |
| 11. | Orlinsky (1962) | 25 | 908 | Any specific content. | 86 | 42 |
| 12. | Rechtschaffen _et al_ (1963) | 17 | 282 | Some specific content. | 86 | 23 |
| 13. | Foulkes & Rechtschaffen (1964) | 24 | 227 | Any specific content. | 89 | 62 |
| 14. | Goodenough _et al_ (1965a) | 10 | 357 | a) Content classified as dream by subject. | 76 | 21 |
| | | | | b) Content classified as thinking by subject. | 8 | 24* |
| 15. | Kales et al (1967b) | 3 | 242 | a) Presence of any sensory imagery with development and progression of the mental activity. | 81 | 7 |
| | | | | b) 'Thinking'. | 2 | 28* |

* See text.

The qualitative and quantitative differences between REM and NREM recall have been highlighted by two studies in which both 'dreaming' and 'thinking' criteria were employed. Kales <u>et al</u> (1967b) found that judging reports for the 'presence of any sensory imagery with development and progression of the mental activity' produced recall in 81% of REM and only 7% of NREM awakenings. In contrast, 'thinking' reports were recalled in only 2% of REM but 28% of NREM awakenings. A similar finding has been reported by Goodenough <u>et al</u> (1965a) in a study in which the subjects classified their own reports as 'dreaming' and 'thinking'. In fact, it appears that, regardless of the retrievability of content, subjects usually maintain that they were dreaming following REM, but not NREM, awakenings (Kremen, 1961). Moreover, experienced judges, working 'blind' have been able to discriminate REM reports from NREM reports with 90% success (Munroe <u>et al</u>, 1965). These reports were also divided into those that had the typical features of dreams and those that were more like waking thinking. Faced with these two groups of reports, the judges were still able to distinguish REM-'thinking' from NREM-'thinking' and REM-'dreaming' from NREM-'dreaming' with considerable success.

Although the above data are highly suggestive, they do not actually demonstrate that dreaming (as against thinking) is an ongoing process during REM sleep.

It is possible, for example, that the dreams occurred at some other time, but were better recalled during REM sleep. This is plausible since, as the EEG attests, REM sleep is a state of relative arousal. Moreover, there is evidence that material learned prior to retiring is recalled better following REM than NREM awakenings (Stones, 1973).[8]

If dreaming does occur during REM sleep, the length of the dream report should be related to the amount of REM sleep prior to awakening. Manipulating the amount of REM sleep preceding awakenings, Dement & Kleitman (1957b) found that subjects guessed accurately, on the basis of their dream narratives, whether they had been dreaming for the shorter (5 minutes) or longer (15 minutes) period. The investigators also showed that for each subject, the length of the dream narratives (number of words) increased with the duration of REM sleep. Indeed, Dement (1958) has shown that the acting out, in waking life, of the content of the dream narrative takes about as long as the duration of REM sleep from which the dream was taken.

8 This line of argument must offer an explanation for the better retention of 'thinking' experiences than the more vivid 'dreaming' experiences following NREM awakenings. One possibility is that the thoughtlike experiences may occur while the subject is awakening. This suggestion draws some support from the higher incidence of thinking reports elicited following gradual awakenings from NREM sleep than following abrupt awakenings (Goodenough _et al_, 1965a; Shapiro _et al_, 1963, 1965).

Additional evidence supporting the temporal location of dream-like experience in REM sleep comes from the observation that auditory, visual or tactile stimuli presented during REM sleep are frequently incorporated into subsequently reported dreams (Dement & Wolpert, 1958; Berger, 1963). The lengths of experienced time between the incorporated stimulus event and the end of the dream correlates well with the real time between the stimulus presentation and the subsequent awakening.[9]

Finally, it has been suggested that the eye movements actually represent the scanning of hallucinated dream images. Dement & Kleitman (1957b), Dement & Wolpert (1958) and Roffwarg et al (1962) have all described correspondences between reported visual dream imagery and the patterns of eye movements occurring immediately prior to awakenings from REM sleep. In the most detailed analysis, Roffwarg and his associates were able, when dream recall was vivid, to accurately predict the direction, timing and sequence of eye movements from the dream protocols alone in 70% to 80% of the instances without recourse to the EOG tracings.

9 Incorporation of external stimuli into cognitive experiences recalled following NREM awakenings is rare (Rechtschaffen et al, 1963), and correlations of the subjective duration of conscious experience with the duration of the preceding period of NREM sleep have not been reported.

A number of findings have been taken to discredit this scanning hypothesis, however. In particular, the presence of eye movements during REM sleep in neonates (Roffwarg _et al_, 1966) and the congenitally blind (Gross _et al_, 1965; Amadeo & Gomez, 1966) have usually been taken (e.g., Berger, 1967; Oswald, 1970) as contrary evidence. Presumably, there is no visual imagery associated with the eye movements in these cases. But as far as disproving the scanning hypothesis, these findings would seem irrelevant - as irrelevant as deducing from the presence of mouth movements and vocalisations in the unschooled congenitally deaf and dumb that similar phenomena in normals can have no specific relation to meaningful verbalised content. Obviously they can. In a similar fashion, eye movements present at birth may become linked to scanning with the development of visual dreaming.

Of more relevance, perhaps, are the objections based on normal data. The presence of visual imagery in the absence of rapid eye movements - during NREM sleep (Foulkes, 1962) and, particularly, the onset of sleep (Foulkes _et al_, 1966; Foulkes & Vogel, 1965; Molinari & Foulkes, 1969) - has been cited as 'difficult to reconcile' with the scanning hypothesis (Berger, 1969). However, this finding hardly precludes the possibility of a close link between eye movement patterning and the visual imagery of the dream where eye movements are permitted expression. More difficult to discount are the consistent individual biases in predominance of REMs in either a horizontal or vertical plane (Spreng _et al_, 1968). Such constancies in patterns of eye movements do appear inconsistent with the notion that they are visual scanning movements as dreams differ considerably in their visual content from one period of REM sleep to another and from one night to another.

What of the NREM awakenings that elicit dreamlike reports? It might be argued that these reports reflect the 'holding', or 're-running', of preceding experiences, originally encountered in REM sleep, during their subsequent cognitive elaboration or conceptual synthesis. The 'flow' of many dreams collected during laboratory studies does nothing to discredit this notion; and there is little reason to suppose that secondary revision cannot take place during both REM and NREM sleep. Moreover, an interaction between mental content taken from REM and NREM sleep has been demonstrated (Rechtschaffen, Vogel & Shaikun, 1963).

It is probable that mental activity does not totally cease at any time during sleep, a view that is widely held (e.g., Foulkes, 1967a; Berger, 1967; Dement, 1967); a conscious stream of thought persisting throughout sleep. And although the findings do not allow us to assert that all dreams occur during REM sleep, or even that all REM sleep is associated with dreaming, nevertheless the very strong relationship existing between the two does allow us to recognise, gain access to and interrupt ongoing dream experience with a high degree of probability.

## REM Sleep Awakenings as a Means of Testing Repression

Despite this recognition of the association between REM sleep and dreaming, little investigation of the influence of repression on dream recall following awakenings from REM sleep has resulted. Perhaps this is due, in part, to the view that dreams collected in the laboratory are more mundane than those collected at home (Domhoff & Kamiya, 1964; Hall & Van de Castle, 1966). For if the laboratory context does exert a constraining effect, making dreams more mundane, then (or so the argument runs) this would reduce the frequency of dreams that may be suitable candidates for repression.[10] However, this drawback may be more apparent than real.

Firstly, the nature of home recall conditions are such that presumably only the most vivid dreams, and those occurring just before morning arousal, stand a

10 The assumption that apparently 'mundane' dreams are not threatening to the dreamer may in itself be misguided. Freud has this to say on the question of mundane dreams: "When I have reconstructed the dream-thoughts, I habitually find the most intense psychical impulses in them striving to make themselves felt and struggling as a rule against others that are sharply opposed to them. If I then turn back to the dream, it not infrequently appears colourless, and without emotional tone of any great intensity. The dream-work has reduced to a level of indifference not only the content but often the emotional tone of my thoughts as well." (1954, p. 467).

chance of surviving the night's sleep: in fact the two appear related since, in laboratory studies, dreams have been found to increase in vividness toward morning (Shapiro, Goodenough & Gryler, 1963; Foulkes, 1966). In other words, home dreams are a highly selected sample. This trend may be further exaggerated by the fact that vivid, and particularly unpleasant, dreams often cause us to awaken and, as a result, are better remembered. Laboratory awakenings, too, are selective, but on the basis of very different considerations. Typically, investigators awaken their subjects within ten minutes or so of the onset of REM sleep. The purpose of this is to avoid the possibility of losing an awakening through the sleeper slipping back into NREM sleep. This relatively early interruption of periods of REM sleep may be crucial since delayed REM awakenings have been found to produce more active, distorted, dramatic, emotional, anxious and unpleasant reports, with more socially unacceptable content (violence and hostility) and less voluntary control than awakenings taken shortly after REM sleep onset (Foulkes, 1966). Secondly, in the laboratory, dreams are usually tape-recorded in social interaction with the experimenter, whereas at home dreams are written down in privacy. In other words, the recall of more prosaic dreams in laboratory than home samples may reflect the selective recall of dream content rather than the influence of the setting or of being 'wired up' on what is dreamt.

In support of these reservations, the one study that has attempted to match the dream sampling conditions found little difference between home and laboratory dreams (Weisz & Foulkes, 1970). Both at home and wired up in the laboratory, subjects were woken by an alarm clock at 6.30 a.m. and reported any dream they recalled in privacy by means of a portable tape recorder by their bedside. The reports were rated on the following dimensions: Vivid Fantasy (unreality, drama and intensity of dream experience); Hedonic Tone; Active Control (or participation by the self-character in the dream); Verbal Aggression; Physical Aggression; and Sexuality. Of these six scales, only Verbal Aggression was found to discriminate home from laboratory-collected dreams, home dreams having the higher proportion of such instances. Weisz & Foulkes concluded that:

> "the raw material of the dream may be slightly different in the laboratory than at home" (a reference to the greater proportion of laboratory dreams incorporating some aspect of the experimental situation) "but.... the 'dream work' is not." (1970, p. 593).

On this evidence, there would seem little justification for the claim that the laboratory situation serves to stultify dream experience.

The few laboratory studies of dream recall that do relate to the repression hypothesis seem, at first glance, equivocal in their findings. Evidence for the repression of dreams comes from studies which have examined the effects of presleep viewing of stressful films on subsequent dream recall. If, as has been suggested (Foulkes & Rechtschaffen, 1964), this technique charges the mood of subjects' dreams, then the finding of significant increases in the incidence of failure to recall dream content from REM sleep awakenings following the viewing of stressful dreams (Foulkes, et al, 1967; Cartwright et al, 1969; Goodenough et al, 1974) may be taken to support dream repression.

The study by Goodenough and his colleagues is particularly revealing. For this study used two groups of subjects - 'less-differentiated' and 'more-differentiated' - that have been found to differ in their characteristic use of defence mechanisms (Witkin et al, 1962). Less-differentiated individuals typically use such global defences as denial and repression, whereas more-differentiated individuals more often display specialised defences such as isolation and intellectualisation. This is a distinction in terms of defensive behaviour very similar to that hypothesised to exist between convergers and divergers. Interestingly, the increase in dream recall failures following the stressful films was restricted to the limitedly differentiated group, the postulated repressers.

In fact, with the more-differentiated group there was a slight, but insignificant, increase in dream recall following the stressful films. Goodenough et al also distinguished two types of recall failures: wakings eliciting 'forgotten' reports in which the subject insisted that he had been dreaming yet was unable to recall any of the specific content; and wakings eliciting reports of dreamless sleep. The increase in dream recall failure observed in the less-differentiated individuals following the stressful films was found to be entirely attributable to an increase in the frequency of 'forgotten' reports. This also seems to support the operation of repression on dreams as, phenomenologically, it is this 'forgotten' type of report that best fits the action of repression.

However, two earlier studies employing the technique of presleep stress film viewing (Foulkes & Rechtschaffen, 1964; Karacan et al, 1966) found that this procedure had no effect on dream recall from REM sleep awakenings.[11] It may be that in both these studies the stress films failed to excite the subjects' dreams. In one of these studies (Karacan et al, 1966), this was actually demonstrated; the stress films were

11 Foulkes & Rechtschaffen (1964) also found no relation between a test measure of repression and incidence of dream recall following arousal from REM sleep.

found to have no effect on the intensity of feelings expressed in the dream protocols. In fact this might have been predicted as the study used a penis gauge[12] in all sleep sessions. As its use was likely to have been extremely stressful, any possible effects of the stress film would have been overridden. Foulkes & Rechtschaffen (1964), on the other hand, did find that the dreams reported following the stressful film were more vivid than these following a neutral film. This was somewhat contradicted, however, by the additional finding that the stressful film did not alter eye movement profusion during REM sleep - a measure generally found to reflect the psychological intensity of the accompanying dreams (Dement & Wolpert, 1958; Berger & Oswald, 1962; Goodenough _et al_, 1965b; Hobson _et al_ 1965; Karacan _et al_, 1966; Pivik & Foulkes, 1966; Molinari & Foulkes, 1969; Hauri & van de Castle, 1970; Takeo, 1970; Goodenough _et al_, 1974). Moreover, the 'violent' film employed by Foulkes & Rechtschaffen was a Western which, by present-day standards, would seem quite unexceptional. It is highly questionable whether the film would have profoundly disturbed the onlooking subjects, and, as a result, led to more affectively-toned dreaming. In this connection, the two adult studies that found stressful films did affect dream

12 This device is a loop placed over the penis in order to detect penile erections.

recall used sexually exciting films (Cartwright et al, 1969) and films of a subincision rite and childbirth (Goodenough et al, 1974).[13] These films seem a better means of tapping threatening impulses that might be 'worked on' during the subsequent night's dreaming.

Obviously, the question of whether stressful films do in fact colour dreams is crucial in deciding whether failure to recall dreams following these films is attributable to repression. The matter is complicated by the fact that, even if stressful films do charge the following night's dreaming with emotion, this effect would still not necessarily be observed in the reported dreams. For this is precisely the category of dream on which repression would operate. More reliable evidence might be obtained from the physiological indices that have

13 The sexually exciting 'stag movies' included scenes of foreplay, fellatio, cunnilingus and coitus. The subincision film was of a rite practised by the aboriginal group, the Arunta. It shows a number of old men preparing for the initiation of younger men. All the men are naked. A number of incision episodes are shown. Each initiate lies down across the backs of the other initiates who are perched on all fours close to each other. An incision is made with a sharp stone along the ventral surface of the penis and scrotum. The bleeding penis is then seen being held over a fire. The faces of the initiates clearly reflect their anguish. The Birth film was a medical teaching film. The exposed vagina and thighs of the woman, painted with iodine, are shown. The arm of the physician is seen inserting a vacuum extractor into the vagina; the gloved hands and arms of the obstetrician, covered with blood, are then shown pulling periodically on a chain protruding from the vagina. The cutting motion of an episiotomy is also shown. The baby is then delivered with a gush of blood. The film is in colour.

been associated with an intensification of dreaming. The little data available that bears on this question is most encouraging. Baekeland _et al_ (1968), using the subincision film previously mentioned, found that, in sleep sessions preceded by the stressful film, subjects displayed both more eye movement activity during REM sleep and more spontaneous awakenings from REM (but not NREM) sleep than in sleep sessions preceded by a neutral film. As both of these variables seem to be positively related to vividness in the dream experience, this supports the view that stressful films do intensify dreaming, which, in turn, strengthens the case for laboratory repression of dreams.

## Austin's Study

The study of dream repression of most direct relevance to the present investigation is that of Austin (1971), for he also sought verification for the presence of a repressive orientation in the converger by comparing the dream recall of convergent and divergent subjects. Austin found that convergers recalled dreams on only 65% of awakenings from REM sleep whereas divergers did so on over 95% of awakenings ($p < .005$). On the face of it, this seems strong support for the view that convergers react to threatening experiences by repressing while divergers do not. In addition, on awakenings eliciting recall, convergers' reports were shorter than those of divergers: the mean number of words used were 58 and 196 respectively ($p<.005$). This too is to be expected if convergers are repressing substantial amounts of dream experience.

A closer look at Austin's experimental design introduces certain reservations, however. Noting the association of eye movement activity with the vividness of the reported dream, Austin concerned himself with taking awakenings, whenever possible, following a burst of eye movements. As he restricted awakenings to within 10 and 12 minutes of the onset of REM sleep (presumably so that the reports elicited were strictly comparable with respect to length), he occasionally had to settle for an awakening during REM sleep without eye movements. However, no attempt was made to introduce a second category of awakening - one that he could predict would elicit non-threatening, and therefore non-repressible, dreams - that might serve as a control condition. Because of this, these results must be viewed with some caution. Certainly, it does not seem strictly necessary to invoke repression in explaining the differential recall observed. It might equally be argued that the convergers' poor performance reflects either a lower incidence of vivid, and therefore memorable, dreams, or an indifference towards them; theirs may be a personality that accords the 'inner self' little importance.

Austin dismissed the possibility that convergers have fewer vivid dreams on the grounds that, in other research, home 'recallers' and 'non-recallers' of dreams had not differed in the profusion of their rapid eye movements (Lewis et al, 1966) - a measure, as already mentioned, generally found to reflect the vividness of dreams. These so-called 'non-recallers' were individuals who claimed they rarely, if ever, dreamt. Once in the laboratory, however, nearly half of them became recallers (Lewis et al, 1966). Clearly, the question of whether convergers do, in fact, dream less, or less vividly, requires elucidation. If convergers can be characterised as less imaginative during the day, it should not surprise us if they also prove less imaginative by night.

A further difficulty with Austin's study was that his convergers and divergers, with one exception, were drawn from two distinct academic disciplines - engineering and history respectively. Again, it may be that the differences in recall reflected a habit or a consciously adopted difference in attitude or style between engineers and historians, rather than greater or lesser degrees of repression. And even if this were not so, the differences in recall - particularly with respect to the length of the dream reports - between convergers and divergers might still be attributed to differences in verbal fluency between the two groups, since the majority of convergers were low scorers on the open-ended tests, and the divergers high scorers.[14]

Clearly, if the convergers' postulated repression of dreams is to be tested rigorously, certain refinements of Austin's study are required. The groups of convergers and divergers must be balanced, both in terms of their academic backgrounds and their verbal fluency; a conclusion must be reached about the relative eye movement profusion displayed by the two groups; and, most of all, a control category of awakening introduced. For it is not enough merely to show that convergers are poor at recalling dream experiences that may be threatening; it must also be demonstrated that they are not equally poor at recalling non-threatening dream experience.

Fortunately, further developments in the electrophysiological study of sleep have suggested just such a control awakening.

<u>REM Sleep - An Internal Distinction</u>

The physiological model generated by the Aserinsky-Kleitman findings made a qualitative distinction between the properties of REM sleep and those of NREM sleep. More recently, a distinction has been made within REM sleep itself. Moruzzi (1963) pointed out that some of the

14 This is not an inevitable consequence as convergence and divergence are measures of <u>bias</u> toward one or other of the two types of test.

physiological features of REM sleep are 'tonic' - that is they extend more or less continuously throughout what had previously been considered to be a unitary 'period' of REM sleep. These include, for example, the low-voltage mixed frequency EEG tracing and the mental and submental EMG suppression. In contrast, other features of REM sleep, most notably the rapid eye movements themselves, are 'phasic' - that is they occur only intermittently during REM sleep.[15] In substantiation of this physiologically-based distinction, other research has demonstrated the neuroanatomical independence of tonic and phasic features of REM sleep (Jouvet, 1967; Pompeiano, 1967).

It is apparent, then, that a physiological model which makes a qualitative distinction between REM and NREM sleep, but none within periods of REM sleep, is no longer adequate. Specifically, the tonic-phasic model provides a means of recognising important variations within REM sleep and the similarities as well as the differences between REM and NREM sleep.

15 Bursts of eye movement activity within REM sleep have been found to correlate temporally with a number of other physiological changes such as pontine-geniculate-occipital 'spiking' in the EEG (Pompeiano, 1967), pupillary dilation (Berluchi & Strata, 1965), electrodermal responses (Broughton et al, 1965) a shallowing of respiration (Aserinsky, 1967), and augmented EMG suppressions (Pompeiano, 1967) but with increased fine muscle activity (Baldridge, Whitman & Kramer, 1965).

What are the implications of this tonic-phasic model for mental activity during REM sleep? In the past, psychological differences within REM sleep have tended to be played down in the interests of highlighting and maintaining the REM/NREM sleep dichotomy. Nevertheless, a number of studies have reported correspondences between mental content and associated eye movement activity during REM sleep, although usually of a less specific nature than that suggested by the scanning hypothesis. Periods of REM sleep with profuse eye movement activity have yielded dreams that have been variously described as more active, vivid, intense, emotional and anxiety-provoking than REM sleep characterised by few eye movements (Dement & Wolpert, 1958; Berger & Oswald, 1962; Goodenough _et al_ 1965b; Hobson _et al_, 1965; Pivik & Foulkes, 1966; Karacan _et al_ 1966; Hauri & van de Castle, 1970; Takeo, 1970; Goodenough _et al_, 1974).

If, as these studies suggest, different kinds of dream experience are associated with physiological variations within REM sleep, then this stage of sleep may not be a homogeneous psychological entity any more than a physiological one. Aserinsky (1967), noting the correlation of a number of non-visual physiological parameters with bursts of eye movement activity, suggested that episodes of ocular activity and those of ocular quiescence must be differentiated in more general phenomenal terms than those specified by the scanning hypothesis. He speculated that the different types of intra-REM sleep episode might be related to different 'levels' of dreaming, specifically suggesting that episodes of ocular quiescence might be associated with the more thoughtlike experience typical of NREM sleep. Much as the tonic-phasic model does - only this time at a psychological level of discourse - this viewpoint focuses attention on phasic-related events within REM sleep as being responsible for what was previously regarded as the distinctive aspects of REM sleep 'periods'.

Following up Aserinsky's speculation experimentally, Molinari & Foulkes (1969) collected reports from ocularly quiescent (REM-Q) and ocularly active (REM-M) episodes of REM sleep, as well as from NREM sleep, with instructions to report the very last preawakening experience. The investigators grouped the reports into two categories: those containing some evidence of 'secondary cognitive elaboration' (SCE), with or without visual imagery; and those visual reports containing no evidence of secondary elaboration, labelled 'primary visual experience' (PVE). These classifications were arrived at both deductively and inductively, and the criteria for scoring a report as SCE is fully described in Chapter 4. Most of the criteria were drawn from earlier studies of the quality of NREM-related experience but some of the subcategories of conceptual activity were included <u>post hoc</u> if they discriminated REM-M from REM-Q reports.[16] Nevertheless, subsequent 'blind' judging proved reliable and Molinari & Foulkes found that 80% of the reports collected from REM-Q and 77% of the reports collected from NREM awakenings were classified as SCE, the remainder being classified residually as PVE. With reports collected from REM-M awakenings, in contrast, only 12% were classified as SCE and 88% as PVE.

In other words, dream experiences predominating during REM-Q episodes contained either visual imagery along with active cognitive processes which elaborate, interpret, or in some way reflect on this imagery, or purely cognitive processes in the absence of any visual imagery. REM-M episodes, on the other hand, were associated with visual imagery but without any cognitive elaboration of these events.

## PVE and SCE and Mechanisms of Defence

In essence, the SCE/PVE distinction made by Molinari & Foulkes rests on the presence or absence of intellectual activity in the dream report. Freud (1949) claimed that intellectual elements of the manifest dream are not the product of the dream-work. Where intellectual activity does manifest itself in the dream, it can be attributed to either of two sources. It may be the

16 Clearly, these categories must be viewed with some caution until cross-validated.

result of dream-thoughts arriving unaltered at the manifest level. Such audacity suggests that these are dream-thoughts that are not threatening. They are latent because of their unattended rather than repressed status; their preconscious rather than unconscious origin. An alternative source of intellectual activity, and one of particular interest here, is secondary revision, making its appearance after the dream has entered consciousness. In other words, the presence of intellectual activity in the dream experience suggests either that the dream is not threatening, or, at least, that it has been rendered less so by revision.

If this is the case, then the expression of our threatening 'wishes' is the preserve of REM-M-related PVE.[17] This view draws support from the 'frustration' effects and the reduction of 'ego control' observed in some human subjects selectively deprived of their REM sleep requirement (Dement, 1960; Sampson, 1966; Clemes

17 In this connection, striking drive-oriented behaviour has been observed in cats when phasic events, normally occurring during REM-M sleep, were discharged while awake (following treatment with para-chlorophenylalanine; Dement, 1969). The cats developed an impressive repertoire - rage, hypersexuality and hyperphagia - as well as a 'general personality change'. The sexual behaviour, in particular, transcended any semblance of normality:

> ".... we have seen previously indifferent male cats compulsively mount not only anaesthetised male cats and passive male cats, but relentlessly stalk a raging, clawing, highly resistant tom and persevere until the quarry is finally backed into a corner where a mount can be executed." (Dement, 1969, p. 256).

& Dement, 1967; Agnew _et al_, 1967; Greenberg _et al_, 1970) - always assuming that what is critical in REM sleep deprivation is the loss of phasic events (for which there is considerable evidence; Dement, 1969), and hence of PVE.[18] Whether drive expression is in fact prominent in PVE is not clear from Molinari & Foulkes' study, since the classification they employed was based on the form rather than the substance of mental activity. Certainly, the formal characteristics of PVE, as described by Molinari & Foulkes, appear consonant with such an hypothesis:

> "Topographically, PVE bears the stamp of an eruption from the unconscious; structurally, PVE appears to be an intrusion which is ego-alien." (1969, p. 362).

If PVE does indeed harbour hedonistic, normally unconscious impulses, it is presumably this type of experience that brings the converger's tendency to repress into play. And if SCE is at best an additional distortion

18 The findings of these REM sleep deprivation studies are notoriously difficult to interpret. Firstly, it is not possible to deprive subjects of large amounts of REM sleep without also seriously disrupting their NREM sleep; in which case, the effects observed may merely reflect general sleep deprivation rather than the deprivation of REM sleep _per se_. Secondly, REM sleep deprivation involves the deprivation of biological events as well as dreaming: in other words, the psychological effects observed may be a consequence ('spin off') of biological changes. To further complicate matters, there is evidence to suggest that some individuals can 'displace' intense dreaming into NREM sleep (Cartwright _et al_, 1967; Pivik & Foulkes, 1968) along with the phasic physiological features (Pivik _et al_, 1969).

of these impulses in the interests of defence[19] - and providing the link forged between eye movement activity and dream experience holds - then the contrast between REM-M and REM-Q awakenings offers us a crucial test of the repression hypothesis. On the assumption that REM-M awakenings do interrupt threatening dreams, should convergers prove poorer than divergers at recalling dream content following REM-M awakenings only, this would support active repression: if, on the other hand, convergers perform equally badly on both types of awakening, this would favour an alternative, more passive, mode of forgetting. In other words, we are introducing a control category of awakening (REM-Q) within REM sleep, with which to test the repression hypothesis. This is important as it circumvents the possible criticism that any difference found in recall of dreams between the awakening conditions might be a function of different levels of arousal (as measured by the EEG tracings) such as exist between REM and NREM sleep. In addition, restricting the report to the very last preawakening experience increases the likelihood of finding differences in incidence of recall that may be attributed to repression.

19 There is some support for this idea that SCE reports are in an acceptable form whereas PVE ones are not from the results of Molinari & Foulkes: REM-Q awakenings elicited 100% recall; REM-M awakenings elicited 80% recall. The amount of hypothesised repression is relatively small, but the subjects were selected on the basis of their sensitivity and 'openness to experience', one of the criteria for which was good recall of dreams.

For if this restriction was not imposed, subjects might well remember some earlier experience that would qualify the awakening as one eliciting some specific content even where substantial repression may have taken place.

As has already been pointed out, Freud saw his secondary revision as acting on a previous or ongoing dream experience in the interests of defence. And, in view of their description, it is likely that much of Molinari & Foulkes' SCE is akin to secondary revision. Therefore, if the diverger is more prone to intellectualisation, this defensive strategy might be reflected in his spending proportionately more time in SCE than the converger. The converger, conversely, may require less SCE to complete his defences against what he has, or so the hypothesis runs, substantially repressed. If this is so, and if once again the link between SCE and REM sleep without eye movements is confirmed, then <u>divergers should spend a greater proportion of REM sleep than do convergers in REM-Q</u> (as opposed to REM-M) <u>activity</u>. Moreover, as the periods of REM sleep during the latter part of the night's sleep give the more affectively-charged dream reports (Foulkes, 1966), this effect should be most marked in these later periods of REM sleep as these presumably require more defensive effort from the dreamer.

Clearly, the suggestion that intellectual strategies of defence will be reflected in the patterning of eye movement activity within REM sleep is highly speculative. As far as I am aware, this suggestion has not been entertained, far less investigated, elsewhere. Nevertheless, a few threads of evidence do exist that, twisted together, provide support. More-differentiated individuals - who tend to adopt intellectualisation in defence - have been found not only to have less profuse eye movement activity during REM sleep (Lewis et al, 1966) but also to spend more time in REM sleep (Cartwright, 1966) than less-differentiated individuals. Similarly, home recallers of dreams have less profuse eye movement activity while spending more time in REM sleep than home non-recallers of dreams (Antrobus et al, 1964). In other words, in both absolute and proportionate terms, more-differentiated individuals and home recallers of dreams spend more time in REM sleep devoid of eye movement activity. Substituting 'diverger' and 'converger' for, respectively, 'more' or 'less-differentiated' individual - far less 'home recaller' and 'non-recaller' of dreams - is, of course, fraught with danger.[19] Yet at least we have some evidence that two groups, selected on psychological considerations, can differ systematically with respect to their eye movement discharge.

19 Nevertheless, if divergers do spend a greater amount of time than convergers in episodes of REM sleep associated with elaborative activity, this might well contribute to their lengthier dream reports (Austin, 1971).

Finally, one further possibility, not unconnected with the other hypotheses, seems worthy of consideration. It is possible that convergers, in compensation for their supposed repressed daytime existence, are particularly prone to express libidinous drives in their dreams. This hypothesis leans heavily on the psychodynamic notion that we have common psychic drives which must find expression in one way or another; psychic equilibrium must be maintained. According to this reasoning, an unimaginative, drive-repressing day existence might be compensated by a highly-coloured, drive-expressing night life.[20] Hudson has implied just such a compensatory power on the part of the converger's unconscious:

> ".... presumably defences are not rigid for rigidity's sake; they are rigid precisely because the irrational impulses they stem back are unusually potent." (1966, p. 97).

As more intense dream experiences have been associated with those periods of REM sleep characterised by frequent eye movements, such a compensation effect

20 There is some evidence in support of the idea that dreams express drives that do not find an outlet by day. Swanson & Foulkes (1967) found an inverse relationship between manifest dream sexuality and waking desire; and Robbins and Tanck (1969) found less aggression in dreams following a period of extensive community violence. Also, if repressive individuals do indeed compensate during dreaming, they should prove less tolerant of REM sleep deprivation. There is some support for this: less-differentiated subjects proved less capable than more-differentiated ones of delaying fantasy gratification without experiencing ill effects (Cartwright _et al_, 1967). Moreover, 'repressers' react to REM sleep deprivation with more intense dream experience and eye movement profusion subsequently, whereas 'sensitizers' do not (Pivik & Foulkes, 1966).

might well result in convergers displaying a greater profusion of eye movements during REM sleep.[21] In addition, convergers may display a greater need to dream than divergers, expressed in some sort of 'immediacy' effect, such as a shorter REM latency[22], and longer periods of REM sleep early in the night.

21 In one respect, the compensation and intellectualisation hypotheses clash, as both predict more profuse eye movement activity in the converger. A closer analysis of the eye movement activity will have to be undertaken if we are to discriminate between the two effects.

22 The interval between falling asleep and the first period of REM sleep.

PART 11

# CHAPTER 3

## SUBJECT SELECTION

In selecting subjects from a similar population, Austin (1971) relied on a method of advertising for students and screening volunteers individually on the tests discriminating convergers and divergers. Subjects were then judged convergent or divergent on the basis of the test norms of English schoolboys (Hudson, 1966). There seem several drawbacks in adopting this procedure. Firstly, relying on volunteers is less likely to provide a representative population from which to draw extremes. Indeed, there are some grounds for supposing that convergers are by nature non-volunteers.[1] Secondly, testing subjects

1 In a recent study, Margaret Cormack and I asked a group of some 200 biology students to attend a testing session (convergent/divergent tests). Students were provided with a number of alternative times and asked to choose a suitable one. Of this group, about 50% turned up at first asking. This sub-group of responders produced a skewed curve towards the divergent end of the spectrum (among males, there were no extreme convergers but 5 extreme divergers). Subsequently, the remaining individuals were provided with further times and, if this failed, they were sent letters and/or telephoned and offered yet another time. Eventually, over 80% of the original group completed the convergent/divergent tests. The skewness became progressively less marked with successive testings but, even at the end there was not one extreme converger (in terms of previously collected student samples). It is possible, of course, that there were no extreme convergers in this particular group. Subsequently, from the group tested, a number of convergers and divergers were asked to attend an interview, the purpose of which was to ask them to keep a dream diary. Again, male convergers in particular were much less likely to attend than their divergent counterparts.

individually is likely to increase the variability of the test conditions which, in turn, may affect test performance. It has been shown, for example, that changes in the presentation of open-ended tests can produce quite radical differences in test response (Hudson, 1968). Finally, Austin took norms obtained from group tests on English schoolboys and applied them to scores obtained from university students tested on an individual basis. Equating scores gathered from group and individual testing sessions, and those from schoolboys (albeit prospective university candidates for the most part) with university students' scores would both seem dangerous practices.[2] With this in mind, the earlier method used by Hudson (1966) was substituted: by testing whole groups, a representative population of scores was obtained from which extremes in bias were then drawn. One of the reasons Austin shied away from this method, presumably, was the practical difficulty encountered with students. Certainly, this approach is more difficult to carry out successfully with students than with a captive audience of schoolboys. Nevertheless, the advantages would seem to heavily outweigh the disadvantages.

2 English and Scottish schooling may also make a difference, the university students (at Edinburgh) coming mostly from Scottish schools.

Initially, 3 groups of students specialising in engineering, fine arts and architecture were screened. With the engineering and fine arts groups, whole years were addressed at the end of one of their formal lectures and asked if they would be willing to spend approximately one hour at a mutually convenient time in completing some pencil-and-paper tests. On both occasions, the experimenter was introduced by the respective lecturers. The experimenter explained, briefly, that certain individuals who completed the test would subsequently be asked to participate in an experiment on sleep and dreaming that would involve spending several nights in a sleep laboratory. For participation in this experiment, subjects would receive £10, with the added inducement of free breakfast on the nights spent in the sleep laboratory. It was stressed that the experiment would in no way interfere with the normal academic life of the individual. Subjects would merely spend usual sleeping hours in the laboratory and be up in time for the earliest of lectures. It was also stressed that, even if subjects were not interested in the experiment itself, they should still complete the initial tests as this would provide the experimenter with a more representative population of scores on which to draw. Individuals could, if they wished, indicate on the test sheets that they did not wish to participate further in the experiment. A subsequent time was arranged for the test administration which, for both groups, was immediately following a prescribed lecture one week later.

On the test administration sessions, the experimenter entered the room as the lecture finished and reminded the group of the session. The response rate could not be ascertained precisely since some of the individuals who were present at the introductory session may not have been present on the second occasion; and some of those present on the second occasion may not have been present initially and, as a result, may have had other commitments. Of those who were present just prior to the test administration, an estimated 75% of engineers and 80% of artists stayed to do the tests. While the response rate in either case was not high enough to ensure a totally representative population, it was probably as high as could be achieved in the circumstances.[3]

The procedure adopted for screening the group of architecture students and, subsequently, a second group of engineers differed in certain important respects.[4]

3 There may, of course, be something particular about students who do not attend lectures.

4 A second group of engineers was screened owing to difficulties encountered with the divergent engineers originally selected. Although the original group of engineers produced the requisite number (2) of divergers, both had to be dropped: one owing to an outbreak of psoriasis apparently incurred as a result of attaching electrodes to the scalp during the course of the experiment; the other for repeatedly failing to turn up at the laboratory.

On these occasions, the experimenter obtained permission to use a time normally set aside for a lecture. Students turned up quite unaware that they would be asked to complete tests in place of the lecture. As before, the respective lecturers introduced the experimenter who then made the same introductory remarks. On both these occasions, response was 100%.

The fine art and architecture groups contained both male and female students; the engineering groups only male students. All students were tested, if willing, although female test scores were subsequently discarded for the purposes of the present investigation. In addition, all test scores from males who were not native English speakers or who had not been brought up and educated in Britain were also discarded.

Before commencing each testing session, subjects were assured that all responses would be treated confidentially and that no completed tests would be released on any pretext to their department or the University generally. The following tests were administered: the intelligence test, AH5, Parts 1 and 11; the open-ended tests, 'Meanings of Words' and 'Uses of Objects', (See Appendix 1); and the Eysenck Personality Inventory. The intelligence test was given first and the standard presentation, described in the accompanying manual, was followed. After the forty minutes allowed for the intelligence test, subjects were introduced to the open-ended tests with "And now, as Monty Python would have it, for something completely different". It was hoped, in this way, to lighten the general atmosphere created by the intelligence test and also offer a clue that the open-ended tests could be approached in a different manner, without necessarily encouraging individuals to be flippant. It was also mentioned that there was no restriction on responses, nor a time limit. No further instructions were given other than those appearing on the tests - to give as many different meanings of words, or uses of objects, as came to mind. The intention of the above instructions was to give to those who wanted it carte blanche to respond without reservation, while at the same time avoiding defining the situation as one requiring divergent responsiveness as even the most intractable of minds can be coerced into open-ended productivity (Hudson, 1968). The testing procedure, therefore, was seen as one maximising possible differences in open-ended test performance.

An Eysenck Personality Inventory was also given out along with the open-ended tests and subjects were asked to complete this according to the instructions on the Questionnaire, after finishing the open-ended tests. As no time limit was imposed, and subjects were free to go when they had finished, the EPI served the important function of 'buffer'. In addition, it provided extraversion and neuroticism scores, both of which might influence dream recall. Allowing subjects to go when they had finished seemed preferable to making them all wait for the slowest members of the group, since the knowledge that they were holding up others might influence these slower subjects to abandon prematurely their open-ended tests.

TABLE 3.1: TEST SCORES - ACADEMIC DISCIPLINES CONTRASTED

| Group | N | AH5 | | | M of W | | | U of O | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | M | S.D. | Range | M | S.D. | Range | M | S.D. | Range |
| Fine Arts | 12 | 30.0 | 5.0 | 23-42 | 16.3 | 2.9 | 12-22 | 26.3 | 10.6 | 10-50 |
| Architecture | 26 | 39.8 | 6.6 | 30-48 | 16.3 | 2.6 | 11-22 | 27.2 | 12.1 | 5-58 |
| Engineering 1 | 28 | 40.4 | 7.1 | 26-60 | 17.7 | 3.8 | 11-29 | 18.8 | 5.1 | 9-30 |
| Engineering 2 | 36 | 37.4 | 7.0 | 24-54 | 15.6 | 4.1 | 7-28 | 17.8 | 5.8 | 10-51 |
| Combined | 102 | 38.0 | 6.8 | 23-60 | 16.4 | 3.6 | 7-29 | 21.5 | 7.9 | 5-58 |

Table 3.1 presents the raw scores for the different groups on each of the thinking tests: on the AH5, the group of art students performed markedly poorer than the other 3 groups; on the first of the open-ended tests, 'Meanings of Words', there was little to choose between any of the groups; and on the 'Uses of Objects' test, the fine arts and architecture groups produced about 50% more distinguishable uses, on average, than either group of engineers. Taken together, these results complement earlier work suggesting that arts students are more likely to have a relatively low I.Q. and a high open-ended test

performance, whereas students of the physical sciences are more likely to display the opposite trend, a relatively high I.Q. coupled with a low open-ended test performance (Hudson, 1966). Architects, interestingly, rather than occupying an intermediary position, performed well on both I.Q. and open-ended tests, combining the skills of engineer and artist.

The use of 2 groups of engineers provided the opportunity of comparing the two sampling procedures employed. The groups of engineers were drawn from consecutive years specialising in electrical engineering and both were tested during the third year of their course. Differences in group performance on each of the three tests were slight, certainly not sufficient to suggest that the original group, despite the lower response rate, was a less representative sample. It is true that the second group of engineers did produce a range of scores on the 'Uses of Objects' test far exceeding that of the original group. However, this was entirely the result of a single score of 51, the second highest score in this second group being 27.

Individual raw scores on each of the three tests were graded A, B, C, D or E in the respective proportions 1:2:4:2:1. The grades of the two open-ended tests were then averaged to provide a composite open-ended grade. This was then contrasted with the grade obtained by the individual on the Intelligence Test, yielding a differential ranging from +4 (I.Q. grade A and open-ended composite grade E) to -4 (I.Q. grade E and open-ended composite grade A). Finally, these differential scores were once again proportioned out, as far as the bunching of scores allowed, into 1:2:4:2:1 and classified accordingly along the convergent/divergent dimension.

In practice, this produced the following:

TABLE 3.2: DISTRIBUTION OF CONVERGENT/DIVERGENT BIAS IN THE WHOLE SAMPLE

| Differential Score | % of Sample | Status on Converger/ Diverger Dimension |
|---|---|---|
| +2.0 or over | 11% | extreme converger |
| +1.5 and +1.0 | 18% | moderate converger |
| +0.5, 0 and -0.5 | 51% | 'all-rounder' |
| -1.0 and -1.5 | 12% | moderate diverger |
| -2.0 or over | 9% | extreme diverger |

Separating the academic disciplines gave:

TABLE 3.3: DISTRIBUTION OF CONVERGENCE/DIVERGENCE BY ACADEMIC DISCIPLINE

| | Fine Arts | | | Architecture | | | Engineering 1 | | | Engineering 2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | | N | % | | N | % | | N | % | |
| Extr. cons. | 0 | 0 | 17 | 2 | 8 | 27 | 4 | 14 | 39 | 5 | 14 | 28 |
| Mod. cons. | 2 | 17 | | 5 | 19 | | 7 | 25 | | 5 | 14 | |
| 'All-rounders' | 1 | 8 | | 16 | 62 | | 13 | 47 | | 21 | 58 | |
| Mod. dis. | 3 | 25 | 75 | 1 | 4 | 12 | 2 | 7 | 14 | 5 | 14 | 14 |
| Extr. dis. | 6 | 50 | | 2 | 8 | | 2 | 7 | | 0 | 0 | |

Again, as Hudson (1966) has previously found, students of the arts are more likely to be divergent and students of the physical sciences convergent in bias. The sample of male art students is small (n=12) and the highly skewed distribution of bias in this group may be atypical. Nevertheless, the finding that 6 of the 12 members of this group were extreme divergers does suggest that they are quite distinct in this respect. Rather surprisingly, this small group of art students also produced 2 convergers. The architecture students, on this occasion, present a profile very similar to that of the engineers, and not at all like that of the artists. And, once again, a comparison of both groups of engineers reveals nothing to suggest that the two screening procedures led to differences in sampling.

Two convergers and 2 divergers were then selected from each of the 3 academic disciplines.[5] As a consequence of also attempting to match convergers and divergers with respect to their open-ended scores, those selected were not necessarily the most extreme in their respective disciplines.

5 As well as matching the convergent and divergent groups on academic discipline, this selection procedure also allows us to look at the question of academic 'misfits' - in this case, convergent fine arts students and divergent architecture and engineering students (see Table 3.3).

TABLE 3.4: SUBJECTS SELECTED FOR THE LABORATORY EXPERIMENT

| Academic Discipline | Convergence/ Divergence | I.Q. Grade | Open-Ended Grade |
|---|---|---|---|
| Architecture | extreme converger | +2.0 | 0.0 |
| | extreme converger | +1.0 | -1.0 |
| | extreme diverger | -1.0 | +1.0 |
| | extreme diverger | 0.0 | +2.0 |
| Fine Arts | moderate converger | +1.0 | -0.5 |
| | moderate converger | 0.0 | -1.0 |
| | moderate diverger | -2.0 | -0.5 |
| | extreme diverger | -2.0 | 0.0 |
| Engineering | extreme converger | +2.0 | 0.0 |
| | moderate converger | +2.0 | +0.5 |
| | moderate diverger | -2.0 | -1.0 |
| | moderate diverger | -1.0 | +0.5 |

In both the fine arts and engineering groups, it proved possible to select convergers and divergers who were comparable in respect of their open-ended test performance. With the architecture students, however, this was not possible. There were only 3 divergers in this group, and they all had open-ended grades that none of the convergers could hope to match.[6] In other words, 6 convergers and 4 divergers fell within an averaged index of open-ended test performance ranging from -1.0 to +0.5.

6 When this was discovered, a second group of architecture students was screened. However, this group was found, subsequently, to have met the open-ended tests before, and this was reflected in an altogether higher open-ended test performance. As a result, none of this group were used.

TABLE 3.5: OPEN-ENDED TEST GRADES OF SELECTED CONVERGERS AND DIVERGERS

| | Composite Open-Ended Grade | | | | | |
|---|---|---|---|---|---|---|
| | -1.0 | -0.5 | 0.0 | +0.5 | +1.0 | +2.0 |
| Convergers | 2 | 1 | 2 | 1 | - | - |
| Divergers | 1 | 1 | 1 | 1 | 1 | 1 |

This attempt to match selected convergers and divergers on open-ended test performance inevitably resulted in a marked difference between the groups on the intelligence test: convergers, M=45.7; divergers, M=29.8. If 'intelligence', as measured by the AH5, affects dream recall, it would presumably be in the opposite direction to the one hypothesised in this study,[7] although, at this general level of intelligence, differences are unlikely to be a significant factor.

Finally, on the Eysenck Personality Inventory, both convergers and divergers selected had the high neuroticism scores typical of students (M=26.2 and 25.7 respectively). With respect to extraversion scores, the groups were also quite closely matched: convergers, M=20.2; divergers, M=23.5.

7 Schonbar (1959) reported a positive relationship between 'intelligence' and home dream recall.

# CHAPTER 4

## EXPERIMENTAL PROCEDURE

Prior to the experiment, 18 potentially suitable subjects - 6 from each academic discipline - were interviewed. The experimenter explained the procedure involved:

"The experiment involves spending 8 non-consecutive nights in a sleep laboratory housed in the Royal Edinburgh Hospital. On your first night you would be collected and taken there. On each subsequent night you would come to the laboratory at 10.00 p.m. After getting ready for bed, a number of electrodes would be attached to your face and head for the purpose of recording potential differences between any two given points (the electrode placements were then demonstrated). These potential differences are translated by an EEG machine into tracings from which we are able to distinguish several stages or 'depths' of sleep. The purpose of the experiment is to study possible differences in mental content experienced during these different stages of sleep. On the first 4 nights you would be allowed to sleep undisturbed. These nights provide you with the opportunity to acclimatise yourselves to the sleeping situation and, for my part, the opportunity to determine your normal sleeping patterns, for individuals may differ in this respect. On the remaining 4 nights, you would be woken from different stages of sleep and asked to report any mental experience that may have been passing through your mind just prior to arousal. It is very unlikely that you would be woken more than 4 times on any one of these nights. Each morning you would be raised about 7.30 a.m., given a cooked breakfast, and, usually, driven back to the university before 9.00 a.m. In addition, as alcohol and drugs affect sleep patterns and, possibly, also mental content, if you do participate in the experiment you will have to agree to take no alcohol or medicines from at least 72 hours before your first laboratory session until the completion of the experiment. The 8 nights will be spread over approximately 3 to 4 weeks. You would be paid £10. Any questions?".

After clearing up any points raised, interviewees were then asked if they were willing to participate. All indicated that they were willing. Potential subjects were then asked various questions about their sleeping habits. The following were all grounds for exclusion from the experiment: a normal sleeping time of less than 6 hours or more than 9 hours; difficulty experienced in falling asleep after going to bed; difficulty in sleeping in a strange place; difficulty in getting to sleep again if woken in the middle of the night; regular 'naps' taken during the course of the day; being in the habit of taking something to aid sleep (beverages, such as 'Horlicks', as well as sleeping pills); and an unwillingness to report in detail dreams experienced, including those of a personal nature. In practice, these criteria excluded only 2 subjects: one a convergent architect who claimed to habitually sleep no more than 4 to 5 hours a night; the other, a divergent artist who found difficulty both in sleeping in a strange place and in returning to sleep if aroused in the middle of the night. This divergent subject also frequently slept for 10 hours or more when permitted. Most of these criteria are self-explanatory. One reason for avoiding 'long' and 'short' sleepers was the difficulty in comparing their sleep patterns. More important, short sleepers would presumably have fewer periods of REM sleep and thus provide fewer awakening opportunities; and long sleepers might be sleep-deprived as the laboratory design only allowed, at the most, nine hours in bed, and this deprivation might modify these individuals' normal sleep patterns.

Twelve of the remaining 16 subjects were then selected for the laboratory experiment on the basis of their convergent/divergent bias, their academic discipline, and their open-ended test performance, as described in Chapter 3. As already mentioned, both divergent engineering students originally selected had to be dropped. Subsequently, 3 divergers from a second group of engineering students were interviewed and 2 selected on the same basis as before.

Subjects were contacted about 2 weeks before their first laboratory session, given each of the 8 dates they had been allocated, and arrangements made to collect them on their first night. Subjects were also reminded not to take any alcohol or drugs within 72 hours of their first session, and also asked to refrain from taking 'naps' on days when they came to the laboratory.

On arrival, subjects were shown round the laboratory and particularly the EEG machine and then taken to their sleeping accommodation. Subjects were then asked to get ready for bed and to take particular care in washing their faces as any grease was a potential source of interference on the recordings.

Once ready for bed, subjects returned to the laboratory to have the electrodes attached. Each electrode attachment point on the face and head was thoroughly cleaned using spirit and the electrodes securely attached.[1] Six channels were used for each subject: 2 electrooculographic (EOG), 2 electroencephalographic (EEG), and 2 electromyographic (EMG). Using 2 channels for each electrophysiological variable lessened the chance of losing one of the variables through a faulty electrode connection developing during the course of the night.[2]

Subjects were expected to arrive at the laboratory by 10.00 p.m. and were usually in bed by 11.00 p.m. at the latest. With one exception, all 12 subjects spent 8 non-consecutive nights in the laboratory. One subject spent only 7 nights in the laboratory, having missed his

1 The electrode attachment points are illustrated in the figure in Appendix 11.

2 The procedure for rectifying interference is fully described in Appendix 11.

third night through illness. The first 2 nights were adaptation ones, allowing the subjects to become acclimatised to sleeping in the laboratory with electrodes attached. Measurable adaptation effects are usually seen on the first night's recordings only (Rechtschaffen & Verdone, 1964), but a second night provided a safety margin. Nights 3 and 4 were also spent in undisturbed sleep. These 2 nights provided the baseline tracings from which the duration and patterning of REM sleep was determined. On the remaining 4 nights, subjects were awakened and their dream recall tested. It was intended to use the first of these waking nights as an adaptation one as a previous study (Firth, 1972) had demonstrated a markedly lower recall rate on the first waking night. This was not found in the present study, however, and recall data from all 4 waking nights have been included in the results.

Two subjects - 1 converger and 1 diverger - were run on each experimental night, with each subject always having the same partner. In this way, and as far as was possible, any variations that may have occurred from night to night were experienced equally by the convergent and divergent groups. Usually, but always on waking nights, subjects slept in separate rooms adjacent to the laboratory.

On each night subjects came to the laboratory, they were asked if they had consumed any alcohol or drugs of any sort since their last session. In addition to serving as a check, this reinforced the prohibition for subsequent occasions. On undisturbed nights, no special instructions were given and subjects were just encouraged to have a good night's sleep. On waking nights and prior to retiring, subjects were familiarised with the intercommunication system, the signal used to wake them, and the subsequent enquiry procedure. Two points in this enquiry were particularly stressed: firstly, the need to concentrate on the very last preawakening experience to the exclusion of all else; secondly, to report any mental content, no matter how trivial, from this last sequence.

On these waking nights, subjects were aroused in each period of REM sleep from the third of the night onwards. Two types of awakening were taken: REM-M awakenings, taken immediately following or during a burst of eye movements; and REM-Q awakenings, taken after at least 30 seconds of REM sleep without an eye movement.[3] On account of the greater difficulty associated with obtaining a REM-Q awakening, this type of awakening was sought between 5 and 10 minutes after the onset of REM sleep; and if it could not be made, a REM-M awakening was taken instead. Even so, there

3 Examples of electrophysiological tracings preceding REM-M and REM-Q awakenings are presented in Appendix 111.

were nearly twice as many REM-M awakenings taken: with convergers, 36 REM-M and 20 REM-Q awakenings; with divergers, 40 REM-M and 24 REM-Q awakenings. The auditory awakening signal employed was sufficiently loud to ensure abrupt arousal since more gradual awakening results in an increase in the incidence of 'thinking' reports (e.g., Shapiro et al, 1965). On arousal, a standardised interview procedure was conducted by the experimenter from the laboratory through the intercommunication system and taped. The experimenter asked, "Can you tell me the very last thing that was passing through your mind just before I woke you?" To preserve the spontaneity of the response, further interrogation was restricted to an encouraging "Go on" or "Any more details?".[4] Where necessary - for example to clarify a lengthy sequence or to steer a subject away from elaborating an earlier sequence - the experimenter re-asked "What was the very last thing?". Subjects were then simply asked whether there had been any visual imagery present. Finally, in wakings eliciting no recall, and where the information was not offered spontaneously, subjects were asked if they thought they had been experiencing anything just before waking.

4 Responses to clarifying questions might be classified as 'cognitive elaboration' (SCE) and, hence, conceal any possible distinction on the PVE/SCE dichotomy between REM-M and REM-Q awakenings.

The method of data collection adopted in the present study differed from that of Molinari & Foulkes (1969). Presumably to avoid possible contaminating experimenter effects, Molinari & Foulkes adopted a self-administering interview technique in which subjects were required, following arousal, to respond to a written questionnaire that was to hand. However, this technique necessitated switching on a light in the subjects' rooms. Sudden illumination might well lead to a loss of reverie; it therefore seemed appropriate to avoid this in a study, such as the present one, dependent on a measure of incidence of recall.

Data Analysis

Working in ignorance of associated reports of mental content, one judge[5] re-examined all preawakening polygraph tracings to check whether each awakening should be classified as REM-Q or REM-M. Only those awakenings preceded by at least 30 seconds of REM sleep uninterrupted by any eye movements were classified as REM-Q. As a result of this reappraisal, 2 REM-Q awakenings were excluded. In one of these cases, a solitary eye movement intervened just prior to arousal. This was regarded as meeting the criteria of neither category of awakening and was eliminated altogether. In the second case, a burst of eye movements immediately preceded arousal,

5 Mark Austin.

and this awakening was reclassified REM-M. Presumably, both these instances of eye movement activity occurred during the brief, but inevitable, lapse of time between the experimenter deciding to arouse the subject and actually doing so.

Two judges[6], working from typed manuscripts in which reports were ordered by subject and night, were asked to categorise each report as SCE or, residually, PVE, using the following criteria (after Molinari & Foulkes):

Secondary Cognitive Elaboration (SCE) is defined in terms of three broad categories, not mutually exclusive, and each containing two or more subcategories. Category A includes reports with evidence of active intellectual processes within the experience, such as thinking, being aware, recognising or interpreting. Subcategories are: (1) purely conceptual reports, defined as any experience lacking in visual imagery; (2) reports containing visual imagery plus some evidence of a thinking process whether related to the imagery or not; (3) awareness of one's mental processes as an object of consciousness (e.g., "I knew I was wondering about...."); (4) perceptual recognition or interpretation (e.g., "I was trying to place it, it seemed familiar"). Category B includes reports containing conceptual relationships, alternatives or comparisons. Subcategories are: (1) two apparently parallel thoughts or dream events seen in some relationship to one another (e.g., one line of thinking recognised as being illustrative of another); (2) the conception of opposite possibilities or alternatives (e.g., "The

6 Mark Austin and Hugh Firth.

character was X, but at the same time I thought he might also be Y"); (3) a comparison, or a concern with choosing or deciding. Category C includes reports with verbalisation or explanation: subcategory (1) is the subject himself talking; subcategory (2) is any dream character using words for the explicit purpose of explaining (rather than merely description, for example). If none of these criteria are met, the dream report is classified as Primary Visual Experience (PVE).

In addition, in the case of a fairly lengthy sequence, the judges were instructed to score only the final event. The two judges worked independently and both were ignorant of the associated waking category for each report. Agreement on the SCE/PVE dichotomy was reached on 90% of cases independently, and reconciliation reached on the remaining 10%.

Two further judges[7] were asked to scrutinise the dreams collected for the presence of manifest drive expression. Their instructions were open-ended as to what represented a 'drive'. As before, both judges were unaware of either the awakening category or personality type from which any particular dream was taken. Initially, the judges worked independently and, subsequently, met to compare their analyses. At this reconciliatory meeting (which was also attended by the author), it was decided to include only those instances of drive that were considered most likely to pose an

7 Margaret Cormack and Peter Sheldrake.

overt threat to the dreamer. As a result, aggressive (in the wide sense, including both verbal and physical hostility) and sexual interactions were retained and all other expressions of drive - for example, eating - were discarded. All manifest aggressive and sexual interactions were included, irrespective of whether they related directly to the dreamer himself (they usually did) or of whether any fear or anxiety was associated with the drive expression (the case in approximately 50% of instances). This ad hoc analysis left 16 dream reports that were considered examples of drive expression that might prove threatening, 14 of which had been offered initially by both judges.

The author also counted the number of words used to describe the last experience. Any redundant phrases (e.g., "I was dreaming about....") were excluded, as were any obvious repetitions. In fact, repetitious material proved quite common owing to the often repeated question "So what was the very last thing?" where this was not clear. In reports judged to contain more than one experience, only the last was included in the word count.

The polygraphic records of the two uninterrupted baseline nights were analysed by the author. Tracings were scored for sleep stages according to the current version of the generally accepted Dement-Kleitman system

(Kales & Rechtschaffen, 1967). Total duration of sleep, irrespective of stage was calculated, as well as the duration of REM sleep. Any time spent awake following the occurrence of a spontaneous awakening during the course of the night was deducted from the total sleep time. Sleep featuring predominantly REM sleep characteristics, but with signs of stage 2 features (e.g., spindling or K-complexes) interspersed, was not scored as REM sleep; in other words, only unambiguous REM sleep was scored as such. The number of discrete periods of REM sleep was also noted: if more than ten minutes of unambiguous NREM sleep (no REM sleep features) elapsed between episodes of REM sleep, the episodes were regarded as discrete periods; if less than ten minutes, separated episodes were regarded as belonging to one period. The duration of sleep prior to the first period of REM sleep (REM latency) was also recorded. In cases where the first REM period was 'missed', the latency period was calculated from falling asleep to the 'second' REM period. Finally, the profusion of rapid eye movements within REM sleep was calculated. Periods of REM sleep were split into two-second epochs. The proportion of these epochs containing one or more eye movements was determined and expressed as a percentage.

The most likely source of possible error is in the calculation of these eye movement profusion scores within REM sleep. Therefore, in order to check the author's figures, the four baseline records of the converger and diverger most closely matched on eye movement profusion in the author's analysis were re-examined by another judge[8] who was unaware of the source of the records. With respect to amount of REM sleep, both judges' scoring was in close agreement: and, although the second judge rated both subjects' eye movement profusion slightly higher (1% and 1.2%), their relative standing remained unaltered.

Subsequently, a partial replication was carried out. Ten of the original 12 subjects - 4 convergers and 6 divergers - spent a further 4 nights in the laboratory, 2 adaptation and 2 uninterrupted baseline nights. Once again, 2 subjects were run on each night, although the original procedure of pairing one converger with one diverger could not always be adopted owing to the inequality of the groups. The baseline nights were analysed by 2 judges[9] working 'blind' and the independent scoring was in close harmony. Unfortunately, some of the subjects were run on nights when the eye channels were incorrectly adjusted and, as a result, the eye movement profusion data could not be accurately measured.

8 Mark Austin once again.
9 Ian Oswald and Hugh Firth.

THE HYPOTHESES

The major innovation, indeed the crux of the experimental design, rests on the use of two types of awakening: one during REM sleep with eye movements (REM-M); the other during REM sleep without eye movements (REM-Q). It is the assumption of a clear link between REM-M and REM-Q activity on the one hand, and the characteristics of the dream experience on the other, that lends to the investigation discriminative power. Therefore, it is essential that this link is established at the outset. Specifically, it is hypothesised that:

Awakenings from REM-M activity will elicit dream reports classified as 'Primary Visual Experience' (PVE), whereas awakenings from REM-Q activity will elicit dream reports classified as 'Secondary Cognitive Elaboration' (SCE) (Hypothesis 1).

If this proves to be the case, we are then in a position to test the major hypotheses: firstly, the convergers' tendency to repress threatening dream experience. As only PVE poses a potential threat to the dreamer (as argued in Chapter 2), convergers' dream recall should be poor following awakenings from REM-M (experimental), but not REM-Q (control), activity. Therefore, it is hypothesised that:

Awakenings from REM-M activity will elicit fewer dream reports from convergers than divergers, whereas awakenings from REM-Q activity will result in no difference in incidence of dream recall between the two groups (Hypothesis 2).

The second major hypothesis concerns the divergers' tendency to defend against their dreams by intellectual, revisionary means. As the essence of the SCE/PVE distinction rests on the presence or absence of intellectual activity, defensive cognitive elaboration may occur only during SCE and hence (assuming hypothesis 1 is confirmed) during REM-Q activity. If, therefore, they do elaborate their dreams in the interests of defence, it may be hypothesised that:
Divergers will spend more time than convergers in REM-Q activity, particularly during the later, more threatening, periods of REM sleep (Hypothesis 3).

There is, finally, to be considered the possibility that convergers may need both more immediate and more intense dreaming in compensation for their drive-repressing day. This might be reflected in the distribution of REM sleep throughout the night and the distribution of eye movements within REM sleep. It is hypothesised that:
Convergers will display a shorter REM latency, longer periods of REM sleep early in the night, and a greater profusion of eye movements during REM sleep throughout the night than divergers (Hypothesis 4).

# PART 111

# CHAPTER 5

## DREAM CHARACTERISTICS AND DREAM RECALL

The direction of the present investigation has been prompted by the assumption that episodes of REM sleep with (REM-M) and without (REM-Q) eye movements house qualitatively distinct dream experiences, PVE and SCE respectively. It is this proposed link between eye movement activity and the characteristics of the dream experienced that promises a discriminative line of attack. But, as Molinari & Foulkes' original finding in this direction was to some extent *post-hoc*, the assumption remains fragile. Clearly, it is essential that this link be made secure at the outset.

TABLE 5.1: PERCENTAGE OF DREAM REPORTS CLASSIFIED AS PVE AND SCE FROM REM-M AND REM-Q AWAKENINGS

| | N | SCE | PVE | Visual Reports |
|---|---|---|---|---|
| REM-M | 56 | 13% | 87% | 100% |
| REM-Q | 38 | 89% | 11% | 47% |

As Table 5.1 demonstrates, the distinction between dreams collected from the two types of awakening is clear-cut: with few exceptions, REM-M awakenings elicit dream reports classified as PVE and REM-Q awakenings reports that are judged SCE. Hypothesis 1 is established.

This link between PVE and REM-M activity also suggests that the previously reported 'dream-like' quality of mental experience associated with REM sleep may be related more specifically to the phasic discharge of eye movements. Admittedly, visual reports occur frequently (47%) following arousal from REM-Q activity also, but this may reflect the 'holding' or reminiscence of prior dream experience during its subsequent elaboration. Certainly, the visual imagery associated with REM-Q activity appears to be of an altogether less peremptory nature than that associated with REM-M activity; it is there, without ever captivating the dreamer in the way REM-M related experience appears to do.[1] This is best illustrated by example.

1 This distinction between tonic and phasic features of REM sleep is underlined by their dissociation under certain conditions. For example, cats treated with parachlorophenylalanine discharge phasic events during NREM sleep, and while awake, as well as during REM sleep (Dement, 1969). Of particular interest here is the observation that phasic discharge during the waking state is accompanied by hallucinatory behaviour. It may be, therefore, that the usual synchrony of tonic and phasic features of REM sleep serves as a 'safety valve', tonic peripheral motor inhibition permitting phasic-related psychic expression free reign without the possibility of behavioural consequences.

Some Examples of Dreams Collected and their Classification

1. E. "Can you tell me the very last thing that was passing through your mind just before I woke you?"

   S. "It's a bit mixed up.... I seemed to be playing conkers.... with this girl. She was playing with.... a diamond I think, big and flashing. I had an ordinary conker, and every time she hit my conker it.... hurt me for some reason...."

   E. "Go on."

   S. "I'm not sure how I came to be doing this.... earlier I.... can't remember."

   E. "What was the very last thing?"

   S. ".... My conker had just been hit.... and I had this.... it was more a flash in front of my eyes .... I found it uncomfortable. I can't explain this one well, it's all jumbled up."

   E. "Was there visual imagery?"

   S. "Yes." (Classification: PVE)

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2. E. "Can you tell me the very last thing that was passing through your mind just before I woke you?"

   S. "Yes, just a minute.... I was relating a story of having beer tipped over my head.... The actual beer tipping operation hadn't happened in the dream or whatever, but I was relating the story to a friend, called John, about being in a bar and having beer tipped over my head."

E. "Anything else?"

S. "No, just sitting at a table.... On my left-hand side was a girl called Val and John was sitting opposite me and that was all".

E. "Was there visual imagery?"

S. "Yes, his face was quite plain.... John was sort of casting his eyes to heaven and laughing."

E. "So what was the very last thing passing through your mind?"

S. "I was just saying they had picked up the frame and tipped it over my head and it was full of beer. The frame, I explained, was the thing they drank out of, they didn't drink out of mugs or glasses or anything. It was a wooden frame."

(Classification: SCE)

---

3. E. "Can you tell me the very last thing that was passing through your mind just before I woke you?"

S. ".... I was thinking about blood sports...."

E. "Anything else?"

S. "No.... I was just thinking about it.... The very last thing I was thinking about was Jimmy Edwards for some reason and he's in favour of it and I was just trying to think of someone who is not".

E. "Was there visual imagery?"

S. "No, none at all." (Classification: SCE)

4. E. "Can you tell me the very last thing that was passing through your mind just before I woke you?"

S. ".... I was getting chased by someone with a stick...."

E. "Anything else?"

S. ".... Not really.... it was as if I was in an argument. I must have been."

E. "Was there visual imagery?"

S. "Yeah."

E. "Could you describe the visual imagery?"

S. "I was in a kind of wood, not a very dense wood and I was standing at one side of this tree and he was standing at the other. It was a Xmas tree that had died because all the leaves were off it, and he was running round one way trying to hit me. That was the last thing. I was laughing and wasn't taking it seriously even though he seemed mad at me. There was someone else there but I don't know who." <u>(Classification: PVE)</u>

---

The first and fourth reports were taken from REM-M awakenings and each was classified as PVE by both judges. Both examples appear to have been experienced vividly (e.g., the diamond is described as "big and flashing") despite the hesitant manner in which the first dream, in particular, was reported. In this first dream, the hesitancy appears to have been a function of the bizarre content, and the "jumbled up" nature of the experience. In addition, in the morning, the subject - a divergent architect - reaffirmed that this dream had made him feel "uncomfortable", which was backed up by his taking an uncharacteristic (for him) 30 minutes to return to sleep. In the fourth example, too, the experience appears to have puzzled the dreamer himself - a divergent engineer, on this occasion. He displayed more concern with rationalising the dream situation ("it was as if I was in an argument. I must have been.") than actually describing the scene, although this was eventually extracted in some detail. In both cases, the subjects describe participating in some event, but in an intellectually passive way, without apparent reflection or cognitive elaboration upon the visual imagery at least during the experience.

The second and third dream reports were taken from REM-Q awakenings and classified as SCE by both judges. The second dream involves the retailing of an event, rather than experiencing the event itself, and is accompanied by appropriate, seemingly vivid, imagery. However, here, the dream is reported in a way that suggests the visual aspect is secondary, serving merely to authenticate the intellectual activity, the story-telling. As the dreamer himself - a convergent engineer - was relating the tale, this dream was categorised C1. The third dream - from the same source as the fourth - was classified as SCE on two counts. First, as A1 since the experience was purely conceptual, lacking any visual imagery;[2] second, as B2, since the dreamer was concerned with thinking of an opposite, someone who dislikes blood sports.

2 In fact half (53%) of all REM-Q awakenings elicited reports in this category.

## Dream Recall - Convergers and Divergers Contrasted

The sharp distinction between dreams collected from REM-M and REM-Q awakenings lends purpose to the comparison of convergers and divergers' recall following the two types of awakening. Figure 5.1 contrasts the dream recall of the groups as a whole; and Tables 5.2 and 5.3 compare dream recall on an individual basis. As a group, convergers prove overwhelmingly poorer than divergers at recalling dream content following REM-M awakenings (convergers 50% recall; divergers 95%) but no poorer following REM-Q awakenings.[3] This is precisely what is predicted by the repression hypothesis (Hypothesis 2). Moreover, when looked at on an individual basis (Table 5.2), convergers prove consistently poorer than divergers at recalling dream content following REM-M awakenings. Indeed, 5 of the 6 convergers have a lower recall rate than any of the 6 divergers following REM-M awakenings ($p<.03$, two-tailed, Mann-Whitney U Test[4]).[5]

3 In fact, the contrast is even more striking as recall following REM-Q awakenings is superior for convergers, a point that will be taken up shortly.

4 Siegel (1956).

5 The sixth converger, converger F, has perfect recall but from only 4 REM-M awakenings. In addition, this converger is only marginally convergent (about the 30th percentile from the convergent extreme) within his engineering group. His selection resulted from the attempt to match convergers and divergers' open-ended test scores. The 2 divergers (G and H) who have less than perfect recall following REM-M awakenings have only one failure from 10 and 11 REM-M awakenings respectively.

FIGURE 5.1

DREAM RECALL BY CONVERGERS AND DIVERGERS WHEN WOKEN DURING THE 'MOVEMENT' (REM-M) & QUIESCENT (REM-Q) PHASES OF REM SLEEP

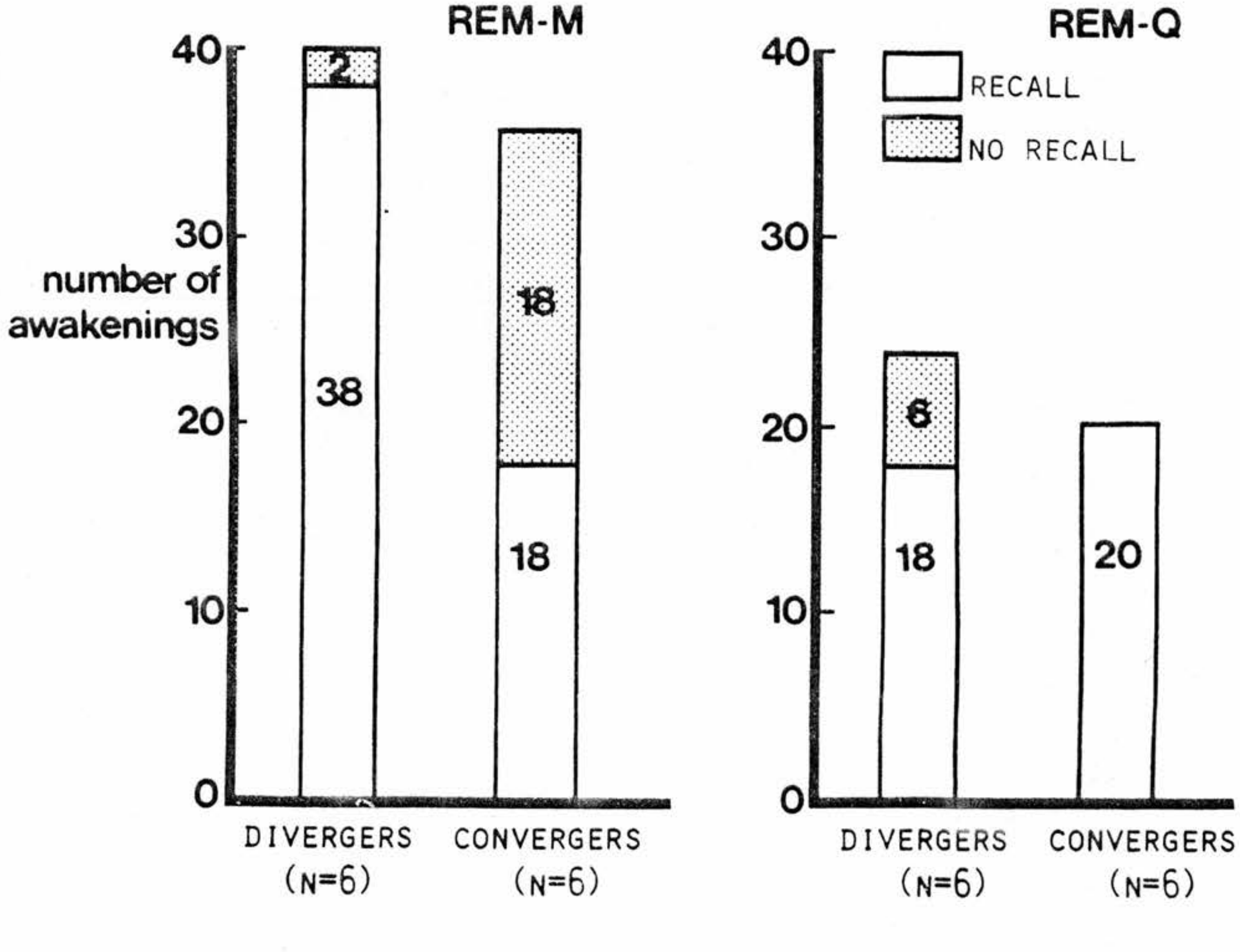


TABLE 5.2: INDIVIDUAL CONVERGERS AND DIVERGERS' DREAM RECALL FOLLOWING REM-M AWAKENINGS

| | Convergers | | | Divergers | |
|---|---|---|---|---|---|
| | No. of Wakings | % Recall | | No. of Wakings | % Recall |
| A. | 8 | 25 | G. | 10 | 90 |
| B. | 9 | 33.3 | H. | 11 | 90.9 |
| C. | 6 | 50 | I. | 5 | 100 |
| D. | 5 | 60 | J. | 2 | 100 |
| E. | 4 | 75 | K. | 7 | 100 |
| F. | 4 | 100 | L. | 5 | 100 |

TABLE 5.3: INDIVIDUAL CONVERGERS AND DIVERGERS' DREAM RECALL FOLLOWING REM-Q AWAKENINGS

| | Convergers | | | Divergers | |
|---|---|---|---|---|---|
| | No. of Wakings | % Recall | | No. of Wakings | % Recall |
| A. | 3 | 100 | G. | 5 | 100 |
| B. | 2 | 100 | H. | 0 * | - |
| C. | 5 | 100 | I. | 2 | 50 |
| D. | 0 * | - | J. | 3 | 33.3 |
| E. | 4 | 100 | K. | 8 | 87.5 |
| F. | 6 | 100 | L. | 6 | 67.7 |

* It proved impossible to obtain REM-Q awakenings from 1 converger and 1 diverger.

If convergers' poor dream recall following REM-M activity is merely a reflection of a negative attitude towards dream experience - generated, for example, by a personality that attaches little importance to the 'inner self' - then convergers' recall following REM-Q activity should be equally affected. If dreams classified as SCE are less vivid than those classified as PVE, then recall following REM-M awakenings should in fact prove better than that following REM-Q awakenings: indeed, this is the trend observed in divergers' recall - 95% of REM-M awakenings produced dream content as against only 75% of REM-Q awakenings. If we attempt to explain convergers' pattern of dream recall in passive terms, we face a paradox: for convergers prove less able to recall the very category of dream (PVE) that appears - from both the physiological and psychological evidence - to be the more intense.

Furthermore, this poor recall on the convergers' part does not seem to reflect a difference in the incidence of their dreams. Of the 18 cases where convergers failed to recall any content following a REM-M awakening, 16 produced assertions of dreaming, 14 of these quite spontaneously, backing up the physiological data. In contrast, there were only 2 REM-M awakenings from which divergers failed to recall any content, and on both occasions the individual concerned reported dreamless sleep.

Indeed this high proportion (89%) of failures among convergers in which dreaming was experienced but the specific content lost may further strengthen the case for repression. For this type of 'forgotten' report seems to follow periods of REM sleep characterised by greater irregularity in the breathing pattern (Shapiro _et al_, 1964), a pattern which often accompanies anxiety in the waking state, and may indicate a strong affective component in the dream experience (Hobson _et al_, 1965). And, as already mentioned (Chapter 2), showing stressful films at bedtime both charges the mood of subjects' dreams (Foulkes & Rechtschaffen, 1964) and increases the frequency of 'forgotten' reports (Goodenough _et al_, 1974) compared with nights on which neutral films were shown. The frequency of dreamless sleep reports, on the other hand, does not increase. If 'forgotten' reports are removed from the analysis, the incidence of recall following REM-M awakenings does not differ for convergers and divergers.

Even more telling, if anecdotal, is the evidence offered by the convergers themselves. On 6 of the 16 awakenings eliciting 'forgotten' reports - an impressive proportion in view of the spontaneity of these remarks - the subject volunteered that the experience he had forgotten had been disturbing, unpleasant or bizarre:

> "Yes.... it was just there.... sorry, it sounds stupid, but I've forgotten it already. I was definitely dreaming just as you woke me.... I wasn't enjoying it....";

"\.... Felt really involved in something....
quite disturbed about being woken up.";

"\.... Don't know, but there was something.... I was conscious of it just before I woke up. I felt quite surprised by what I was dreaming about.";

"\.... I was certainly dreaming about something .... I don't know.... I felt uneasy.... sorry....";

"\.... Damn, its gone.... No.... It was odd, though, I remember that.";

"That dream I couldn't remember last night; I didn't mention it at the time but I felt quite anxious about it. Still can't remember it, I'm afraid....". (reported the following morning).

With respect to REM-Q awakenings (Figure 5.1, Table 5.3), the finding that convergers have a higher recall rate than divergers ($p < .05$, two-tailed, Mann-Whitney U Test) was not anticipated. According to the earlier argument, any forgetting of REM-Q (SCE) experience is passive in nature and should not differ for the two groups. Here there is none of the consistency observed in the convergers' failures following REM-M awakenings. On 3 occasions, the diverger in question reported uncertainty as to whether he had been experiencing anything or not; 2 claimed they had not; and the remaining 1 thought he had.

One alternative to the repression hypothesis - and one which also allows for the divergers' poorer recall following REM-Q awakenings - is to attribute the observed difference to a preference on the part of divergers for visual material and on the part of convergers for material that is non-visual; after all, every REM-M awakening elicited a visual report as against only half (47%) of the awakenings in the REM-Q category. Such an explanation seems unlikely, however, as convergers recalled a higher proportion (55%) of visual reports following REM-Q awakenings than did divergers (39%). Moreover, on this interpretation, engineers display a greater preference for visual material than either artists or architects, since engineers recalled dream content on 90% of REM-M awakenings as against only 67% for artists and 68% for architects.

On the other hand, repression may also be responsible, indirectly, for the finding that divergers are poorer than convergers at recalling dream content following REM-Q awakenings. For if convergers are prone to repress PVE, they may, as a consequence, suffer less proactive inhibition[6] than do divergers from preceding PVE during the SCE (REM-Q activity) which follows. This argument draws some support from the fact that - despite an interview procedure that stressed the reporting

6 Proactive inhibition refers to forgetting brought about by an older memory interfering with a more recent one.

of the very last mental experience to the exclusion of all else - divergers made some reference to an earlier sequence in 28% of cases following REM-Q awakenings; convergers did so in only 5%.[7]

The possibility remains that the poor recall of the convergers following REM-M awakenings is attributable to conscious suppression. On the other hand, both Austin (1971) and I have observed considerable agitation on the part of convergers who fail to recall what they often declare was vivid, and it seems likely that this reflects a genuine inability to retrieve the experience. Moreover, if suppression were responsible, such a conscious process is difficult to equate with such ready admissions of vivid experience.

7 This finding is also telling evidence for the suggestion that divergers prefer intellectual forms of defence, always assuming that, during episodes of REM-Q activity, defensive elaboration of experience released during preceding REM-M episodes may take place.

Manifest Drive Expression in Dream Reports

While the repression hypothesis is strongly supported by the dream recall data, the hypothesis itself hinges on the assumption that REM-M episodes house dream experiences that are potentially threatening to the dreamer, whereas REM-Q episodes reflect dream experiences that are, or have been rendered, innocuous. Evidence in support of this assumption was discussed in Chapter 2. And the very fact that convergers proved poorer at recalling dreams following REM-M awakenings seems to justify, retrospectively, the original assumption. Nevertheless, direct evidence relating to the occurrence of potentially threatening dream experience during episodes of REM-M and REM-Q activity would clearly be more satisfactory.

In the hope of providing just such evidence, the incidence of manifest drive experience in the dream reports was calculated. Any attempt to include disguised drive expression in the analysis was resisted.[8] And the scoring of manifest drive expression was restricted to the occurrence of aggressive or sexual interactions on the grounds that these seemed most likely to pose a threat to the dreamer. As a result, the analysis most probably erred on the side of caution. The findings are presented in Table 5.4.

8 The difficulties inherent in any such attempt are legion.

TABLE 5.4: AWAKENINGS ELICITING DREAM CONTENT WITH MANIFEST DRIVE (AGGRESSIVE & SEXUAL)

| | Convergers | Divergers |
|---|---|---|
| REM-M Awakenings | | |
| Total no. of wakings eliciting dream content: | 18 | 38 |
| No. of these wakings with evidence of drive: | 1 | 11 |
| Percentage of these wakings with drive: | 5.5% | 29% |
| REM-Q Awakenings | | |
| Total no. of wakings eliciting dream content: | 20 | 18 |
| No. of these wakings with evidence of drive: | 2 | 2 |
| Percentage of these wakings with drive: | 10% | 11% |

Convergers recalled few occurrences of aggressive or sexual interactions following either REM-M or REM-Q awakenings. However, this does not contradict the assumption that REM-M activity is associated with threatening, drive-expressing dreams. For if convergers are prone to repress, then they should fail to recall the very dreams that we are seeking. And convergers do fail to recall no less than 50% of their dreams following REM-M awakenings. In other words, if the failures on the part of convergers are attributable to repression, then these lost dreams may be regarded as threatening. On this reasoning, no less than 55% of convergers' REM-M awakenings would be associated with threatening dreams, as against only 10% of their REM-Q awakenings (p=.06, two-tailed, Sign Test[9]).[10]

With the divergers, repression was not considered to be a confounding factor. Certainly, few divergers' dreams were lost following REM-M awakenings (only 5%). And here, as Table 5.4 demonstrates, 29% of the dreams recalled following REM-M awakenings contained manifest drive expression as against only 11% of the dreams recalled following REM-Q awakenings. If dreams containing drive are expressed as a percentage of all divergent awakenings,[11] then the difference is maintained: 27.5% of REM-M awakenings elicited dreams with drive; only 8.3% of REM-Q awakenings elicited dreams with drive (p=.06, two-tailed, Sign Test). The trend does seem to be in the direction of REM-M awakenings more frequently eliciting dreams with manifest drive expression.[12, 13.]

9 Siegel, (1956).

10 As all convergers' REM-Q awakenings elicited dream recall, the 10% incidence is presumably an accurate reflection of manifest drive expression in this case.

11 Allowable with divergers as it is reasonable to conclude that dreams are lost through passive forgetting and not repression; these lost dreams, therefore, are presumably not threatening.

12 A closer look at the 11 divergent REM-M awakenings that elicited drive-expressing dreams, reveals that 4 (36%) of these dreams were classified as SCE; yet only 3 (7%) of the other 45 dreams collected from REM-M awakenings were classified as SCE ($\chi^2$=4.67, p<.05, two-tailed). This association of SCE with drive-expressing dreams, during, or possibly in very brief episodes between, bursts of eye movements suggests both that divergers are prone to respond to drive-expressing dreams with intellectualisation and that this intellectualisation (SCE) may play a defensive role.

13 If we again assume that lost convergent REM-M-related dreams are threatening, it is interesting to note that twice as many convergent REM-M awakenings (55%) are associated with threatening, or at least drive-expressing, dreams than is the case for divergent REM-M awakenings (27.5%) ($\chi^2$=4.06, p<.05, two-tailed). This supports the suggestion that convergers compensate for a drive-repressing daytime existence in their dreams.

Length of Dream Reports

If divergers are more likely to respond to threatening dream experiences with time-consuming intellectualisation, this tendency may be reflected in divergers reporting dreams at greater length following REM-Q awakenings. On the other hand, as cognitive elaboration does not seem to take place to any extent during REM-M activity (Table 5.1), there should be no difference in the length of dream reports elicited from convergers and divergers following REM-M awakenings. It is always possible, of course, that convergent and divergent reporting styles may influence the length of dreams collected quite independently of any intellectualisation; in which case dreams collected from both types of awakening should be equally affected. In order to elucidate this question, the length of dream reports collected from convergers and divergers were contrasted over both types of awakening.[14]

TABLE 5.5: MEAN LENGTH (NO. OF WORDS) OF DREAM REPORTS BY CONVERGENCE/DIVERGENCE

| | Convergers | Divergers | p* (two-tailed) |
|---|---|---|---|
| All wakings | 62.5 | 71.6 | n.s. |
| REM-M wakings | 67.7 | 67.4 | n.s. |
| REM-Q wakings | 54.0 | 86.9 | <.10 |
| Diff. between REM-M and REM-Q wakings | +13.7 | -19.5 | <.06 |

*Computed by the Mann-Whitney U Test (Siegel, 1956). Group means were obtained from individual averages.

14 Two of the 12 subjects - 1 converger and 1 diverger - were excluded from the analysis as neither recalled a dream taken from REM-Q activity.

As Table 5.5 makes clear, the mean number of words used to describe dream experiences following REM-M awakenings was found to be almost identical for convergers and divergers.[15] This similarity rules out the possibility that differences in the style of convergers and divergers' reporting might have some general effect on the length of their dream reports. REM-Q awakenings, on the other hand, did elicit dreams differing in length between convergers and divergers; divergers used about 60% more words to describe their REM-Q-related experiences ($p < .10$, two-tailed, Mann-Whitney U Test).

Comparing dreams collected from the two types of awakening, convergers describe REM-Q experiences more briefly, on average, than REM-M experiences, whereas the opposite is true of divergers. Moreover, this trend is remarkably consistent between individuals within either group, with one notable exception. This exception was, once again, the convergent engineer who was only marginally convergent relative to the other engineering students. For this subject, REM-Q reports were found to average 25.7 words more than REM-M reports. Remove this convergent engineer and the average difference score increases to +22.5 for the convergent group, as well as leaving no overlap whatsoever on these difference scores

15 As only the last preawakening dream experience was sought, and only this experience scored, repression was not expected to affect the length of dream reports taken from REM-M activity. If anything, this finding supports the view that repression acts in an all-or-nothing way on any particular experience - either the experience is lost altogether or it emerges untouched.

between the convergent and divergent groups ($p<.02$, two-tailed, Mann-Whitney U Test).

The inference from these findings is plain: divergers only elaborate during dream experiences associated with REM-Q episodes. This is in keeping not only with the hypothesis that divergers resort to intellectualisation in handling their dreams but also that this intellectualisation is restricted to periods of REM sleep without eye movements.[16]

While considerable comfort may be drawn from these findings relating to dream length, the crucial test of the intellectualisation hypothesis rests on an analysis of the distribution of eye movement activity within REM sleep. It is to this physiological data that we now turn.

16 A consideration of dream length by academic discipline and by open-ended test performance was also undertaken. These two analyses add little to the picture and are presented in Appendices 1V and V.

# CHAPTER 6

## REM SLEEP PATTERNING

This chapter considers the physiological data collected from the uninterrupted baseline nights. In the original study, 2 convergers - 1 through illness and the other a spoiled recording - had only one baseline night on which to draw. All other subjects' data was averaged over the two baseline nights, and group means obtained from these individual averages. Table 6.1 summarises the scoring of these baseline nights:

TABLE 6.1: REM SLEEP PATTERNS OF CONVERGERS AND DIVERGERS

| | Original Expt. | | | Replication | | |
|---|---|---|---|---|---|---|
| | Convergers (n=6) | Divergers (n=6) | p(two-tailed) | Convergers (n=4) | Divergers (n=6) | p(two-tailed) |
| Mean total sleep time (TST) per night (mins) | 392.7 | 455.0 | .02 | 432.2 | 456.0 | n.s. |
| Mean time spent in REM sleep per night (mins) | 73.7 | 99.2 | .05 | 101.5 | 115.8 | .06 |
| Mean time spent in REM sleep as % of TST | 18.5% | 21.8% | n.s. | 23.4% | 25.4% | .09 |
| Mean REM sleep latency+ (mins) | 80.5 | 89.6 | n.s. | 81.7 | 86.9 | n.s. |
| Mean no. of periods of REM sleep per night | 4.2 | 4.4 | n.s. | 4.0 | 4.6 | .02 |
| Mean % eye movement profusion* | 26.5% | 20.0% | .004 | | | |

+Interval between falling asleep and first period of REM sleep.

*Proportion of two-second epochs within REM sleep containing one or more eye movements, expressed as a percentage.

Probabilities were computed using a Mann-Whitney U Test (Siegel, 1956).

Although subjects were not allowed to sleep as long as they wished (they spent no more than $8\frac{1}{2}$ hours in bed), there is over an hour difference between convergers and divergers in the average time spent asleep during the original study. This difference is not maintained in the replication study, however.[1] Divergers also spend longer in REM sleep each night, even when expressed as a percentage of total sleep time.[2] This may be attributable to the divergers' longer sleep since, both proportionately and absolutely, more time is spent in REM sleep as total sleep time lengthens. Also linked to length of sleep, divergers are more likely to have an extra period of REM sleep.[3] Finally - and by far the most consistent difference between the two groups - divergers have a much lower profusion of eye movements during REM sleep than convergers. Profusion scores express the clustering and frequency of eye movements: they are measured by recording the proportion (expressed as a percentage) of two-second epochs within REM sleep containing one or more eye movements. This finding is predicted by both the intellectualisation and compensation hypotheses.

1 The discrepancy between the two studies is not as large as it appears in Table 6.1 as the 4 convergers who participated in the replication averaged 411 minutes of sleep in the original investigation. Clearly, whether convergers are, in fact, shorter sleepers than divergers requires clarification. In this connection, Hartmann _et al_ (1971a, 1972) have reported personality profiles typical of habitual short and long sleepers that are reminiscent of those found in convergers and divergers, respectively.

2 Although the trend is the same in both studies, both convergers and divergers spent more time in REM sleep during the replication. Reasons for this are discussed in Appendix V1.

3 Combining the two studies, divergers had 5 periods of REM sleep on 12 occasions (and a sixth on 1 occasion) during their 24 baseline nights; convergers had only 6 fifth REM periods during 18 baseline nights.

Table 6.2 contrasts the first two periods of REM sleep of the night with those succeeding:

TABLE 6.2: REM SLEEP PATTERNS OF CONVERGERS AND DIVERGERS - EARLY AND LATE PERIODS OF REM SLEEP CONTRASTED

| | Original Expt. | | | Replication | | |
|---|---|---|---|---|---|---|
| | Convergers (n=6) | Divergers (n=6) | p(two-tailed) | Convergers (n=4) | Divergers (n=6) | p(two-tailed |
| REM periods 1 & 2* | | | | | | |
| Mean duration per night (mins) | 30.8 | 26.8 | n.s. | 36.5 | 29.7 | n.s. |
| Mean % eye movement profusion | 22.8% | 17.6% | n.s. | | | |
| REM periods 3 onwards | | | | | | |
| Mean duration per night (mins) | 42.9 | 72.7 | .03 | 65.0 | 86.1 | .01 |
| Mean % eye movement profusion | 27.9% | 20.9% | .002 | | | |

* On occasions where the first REM period was 'missed', 'REM periods 1 & 2' include only the 'second' REM period; in other words, the succeeding REM periods are ranked as if the missed first REM period had occurred.

Probabilities were computed using a Mann-Whitney U Test.

This contrast of early and late periods of REM sleep reveals that the divergent pattern of spending more time in REM sleep is restricted to the latter part of the night. Indeed, during the early part of the night, it is the convergers who spend more time in REM sleep. Convergers also discharge more eye movements within REM sleep than divergers during these early periods of REM sleep. Neither difference satisfied statistically on its own; yet, coupled together, these two trends highlight a clearcut difference. Whereas both groups discharge virtually identical amounts of eye movement activity within

REM sleep over the course of the whole night, convergers discharge 50% more than divergers during the first two periods of REM sleep (convergers, 210.4 two-second epochs containing eye movements; divergers, 141.5 epochs; $p < .02$, two-tailed, Mann-Whitney U Test); and correspondingly less during the later periods of REM sleep (convergers, 370.0; divergers, 452.5; not significant). If these figures are recast in proportionate terms, all 6 convergers have more of their night's REM-M activity during the first two REM periods than any of the divergers (convergers, 36.3%; divergers, 23.8%; $p < .002$, two-tailed, Mann-Whitney U Test). This finding that convergers discharge more eye movement activity than divergers early in the night reflects, according to the compensation hypothesis, a need on the part of convergers for more immediate dreaming.

During the latter part of the night, as already mentioned, it is the divergers who spend significantly more time in REM sleep. While this may be explained, in the original study, merely by divergers spending longer asleep, such an interpretation does not account so readily for the similar pattern in the replication - indeed at an increased level of significance. However, this observation may well reflect divergers' use of time-consuming intellectualisation in handling the more affective content of dreams associated with these later periods of REM sleep (Foulkes, 1966).

The most striking difference between convergers and divergers during these later periods of REM sleep is found, once again, in the profusion of rapid eye movements. On this occasion, there is no overlap whatsoever between the two groups, each converger displaying a higher eye movement profusion than any of the divergers. Moreover, this pattern proves remarkably consistent across individual periods of REM sleep (Table 6.3):

TABLE 6.3: EYE MOVEMENT PROFUSION IN CONVERGERS AND DIVERGERS - INDIVIDUAL REM PERIODS CONTRASTED

| | Mean Percentage Eye Movement Profusion | | |
|---|---|---|---|
| | Convergers | Divergers | p(two-tailed) |
| REM Period | | | |
| 1 | 18.5 | 12.0 | .08 |
| 2 | 23.5 | 19.3 | n.s. |
| 3 | 28.4 | 20.9 | .04 |
| 4 | 26.1 | 19.3 | .08 |
| 5 | 31.0 | 21.1 | .08 |

Probabilities were computed using a Mann-Whitney U Test.

For each of the later periods of REM sleep - REM periods 3, 4 & 5 - as well as for the first REM period of the night, convergers discharge a significantly higher profusion of eye movements. This pattern in the first REM period - and a similar trend in the second - provides further support for the compensation hypothesis in particular. However, the convergers' higher profusion rates in the later REM periods are more difficult to interpret, for both the intellectualisation (Hypothesis 3) and the compensation (Hypothesis 4) hypotheses predict this difference in eye movement profusion between convergers and divergers during the latter part of the night. In support of the intellectualisation hypothesis, this finding may reflect a divergent tendency to spend more time in the totally quiescent episodes of REM sleep that have been linked with SCE; alternatively, divergers may merely spend longer than convergers in low frequency eye movement discharge. In support of the compensation hypothesis, on the other hand, the convergers' higher eye movement profusion may reflect more sustained eye movement activity associated with intense dreaming; although, equally, convergers' profusion rates may be explained by their having fewer episodes of REM-Q activity. Clearly, at this level of analysis, eye movement profusion rates cannot distinguish between the contending hypotheses.[4]

In an attempt to disentangle the intellectualisation and compensation hypotheses, a still closer analysis of the distribution of eye movements within the later periods of REM sleep was undertaken (Table 6.4). On the intellectualisation hypothesis, divergers should spend more time in REM-Q activity, that is page intervals[5] with

4 These hypotheses are not mutually exclusive. It is possible that both effects contribute to the convergers' higher eye movement profusion.

5 The choice of 'pages' (i.e. 20 seconds of polygraphic recording) as the interval was a compromise between taking too large or too small an episode of time: too large might result in a similar figure for a very different pattern, for example if a minute (i.e. 3 pages) was the unit, '5 5 5' and '10 5 0' would both be scored '15' yet be clearly different; too small would tell us no more than Tables 6.2 and 6.3. As 30 seconds of ocular quiescence was the criteria for a REM-Q awakening, this period would have been used, but, as at constituted $1\frac{1}{2}$ pages of recording, it would have proved inconvenient in practice.

TABLE 6.4: EYE MOVEMENT DISTRIBUTION WITHIN THE THIRD AND SUCCEEDING PERIODS OF REM SLEEP (ORIGINAL EXPT.)

| Eye Movement Activity (No. of 2-sec. epochs per page* with one or more eye movements.) | a. Mean no. of Pages* per Night | | | b. % Time in Each Page* Category | | | c. % Time in Each Page* Category (excl. 0) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Convergers (n=6) | Divergers (n=6) | p(one-tailed) | Convergers (n=6) | Divergers (n=6) | p(one-tailed) | Convergers (n=6) | Divergers (n=6) | p(one-tailed) |
| 0 | 31.5 | 83.8 | .001 | 24.5 | 38.3 | .001 | | | |
| 1 | 19.5 | 28.9 | .07 | 15.1 | 13.2 | n.s. | 20.0 | 21.4 | n.s. |
| 2 | 18.2 | 30.3 | .008 | 14.1 | 13.8 | n.s. | 18.7 | 22.4 | .05 |
| 3 | 14.7 | 22.6 | .05 | 11.4 | 10.3 | n.s. | 15.1 | 16.7 | n.s. |
| 4 | 12.3 | 16.8 | n.s. | 9.5 | 7.6 | n.s. | 12.6 | 12.4 | n.s. |
| 5 | 7.4 | 13.0 | .03 | 5.7 | 5.9 | n.s. | 7.6 | 9.6 | n.s. |
| 6 | 9.4 | 9.9 | n.s. | 7.3 | 4.5 | .02 | 9.7 | 7.3 | n.s. |
| 7 | 6.3 | 7.3 | n.s. | 4.9 | 3.4 | n.s. | 6.5 | 5.4 | n.s. |
| 8 | 4.5 | 4.0 | n.s. | 3.5 | 1.8 | .07 | 4.6 | 3.0 | n.s. |
| 9 | 3.7 | 2.0 | .05 | 2.9 | 0.9 | .004 | 3.8 | 1.5 | .02 |
| 10 | 1.3 | 0.25 | .002 | 1.0 | 0.1 | .001 | 1.3 | 0.2 | .001 |

*Each page represents 20 seconds of REM sleep (i.e. 10 two-second epochs).

Probabilities were computed using a Mann-Whitney U Test.

zero eye movements. On the compensation hypothesis, convergers should have more pages with, say, 8, 9 and 10 epochs containing eye movements. In absolute terms, (Table 6.4a), divergers do spend far more time in episodes of REM sleep with no eye movements whatsoever. As convergers spent only about 60% as much time as divergers in these later periods of REM sleep, the proportionate amount of time spent in each category of eye movement activity was also tabulated (Table 6.4b). Again, quite clearly, divergers spend more time in REM-Q activity. In absolute terms, pages with low numbers of epochs containing eye movements are also more prevalent among divergers (Table 6.4a). However, these differences disappear when looked at proportionately (Table 6.4b). Divergers, then, do spend more time in REM-Q activity during later periods of REM sleep which is associated with SCE. SCE, in turn, may serve in a defensive capacity against dream experience of a threatening nature.

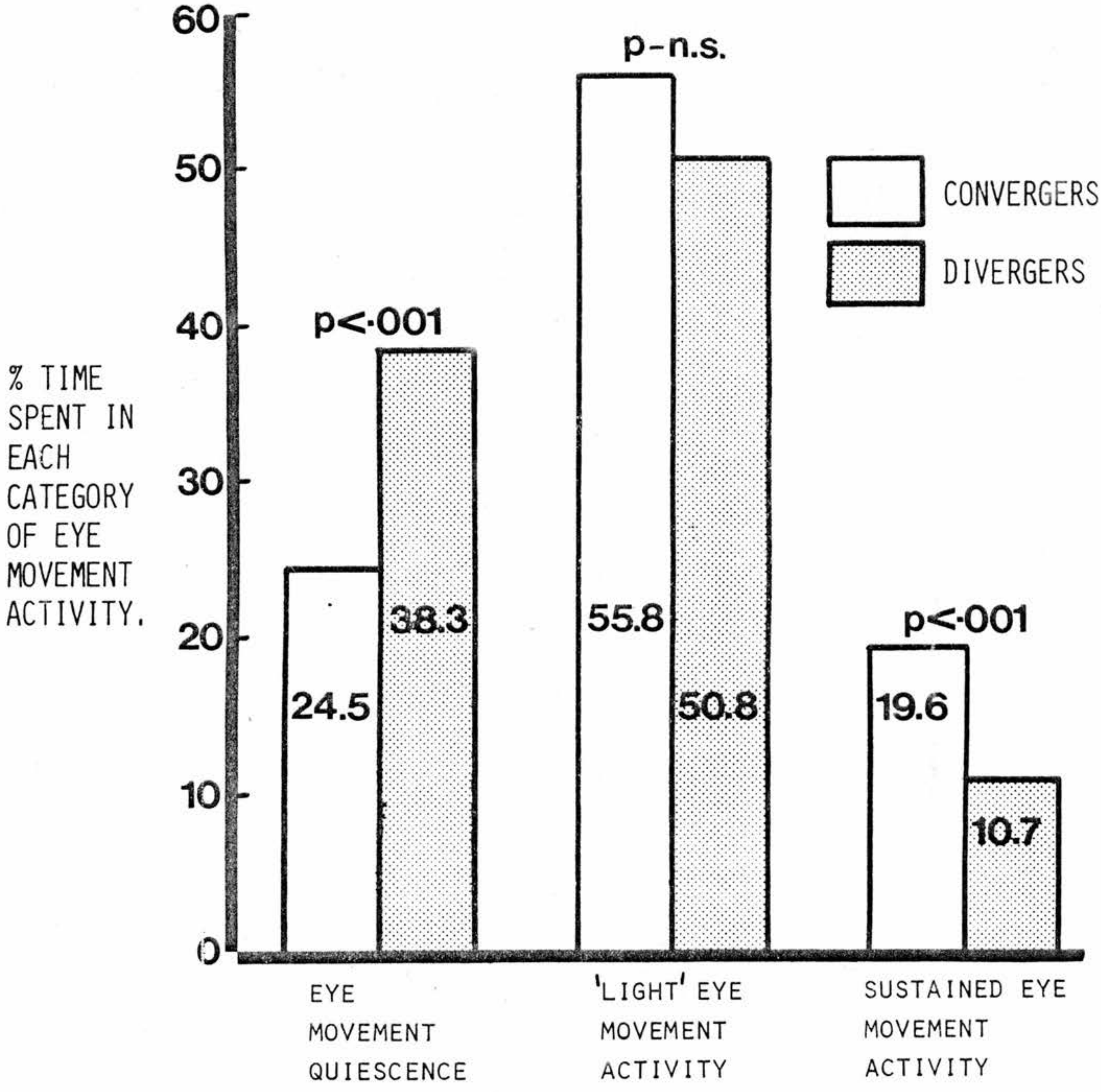
Turning to REM sleep with sustained eye movement activity, convergers are more likely than divergers, in absolute terms, to produce pages with 9 and 10 epochs containing eye movements (Table 6.4a). In view of the much shorter time spent by convergers in these later REM periods, this finding is quite remarkable. And when looked at proportionately this effect is even more marked, pages with 6, 8, 9 and 10 epochs of eye movement activity all occurring significantly more frequently with convergers

(Table 6.4b). In fact, owing to the high proportion of time spent by divergers in pages with zero eye movements, convergers spend proportionately more time in every other category of eye movement activity (Table 6.4b). In order to remove this influence, pages with zero eye movements were excluded (Table 6.4c). This gives a striking 'cross-over' effect, divergers spending proportionately more time than convergers in each category of light eye movement activity (i.e., pages with 1 to 5 epochs containing eye movements) and proportionately less time than convergers in each category of more sustained eye movement activity (i.e., pages with 6 to 10 epochs containing eye movements). Convergers, then, do spend more time, both proportionately and absolutely, in sustained eye movement activity than divergers, substantiating the hypothesis that convergers compensate for a relatively unimaginative daytime existence with more intense dreams. The findings presented in Table 6.4 are summarised in Figure 6.1.

As already indicated, convergers and divergers discharge virtually identical amounts of eye movement activity over the course of the whole night: convergers, 580.4 epochs of REM sleep containing eye movements each night; divergers, 594.0. What differs is the distribution of these eye movements; divergers seem to require a greater amount of REM sleep to discharge a similar amount of eye movement activity.

FIG 6.1

EYE MOVEMENT DISCHARGE WITHIN REM SLEEP - CONVERGERS AND DIVERGERS CONTRASTED




Eye movement activity has been grouped into 3 categories: periods of eye movement quiescence (REM-Q), ie, pages with zero eye movement; periods of 'light' eye movement activity, ie, pages with 1-5 epochs containing eye movements; and periods of sustained eye movement activity, ie, pages with 6-10 epochs containing eye movements. The contrast is striking: divergers clearly spend proportionately more REM sleep in episodes of eye movement quiescence than convergers; and convergers spend proportionately more time than divergers in sustained eye movement activity. Both groups spend a similar proportion of their REM sleep in episodes of light eye movement activity.

On closer inspection, then, the striking difference between convergers and divergers in the distribution of eye movements within REM sleep provides strong support for both the intellectualisation and compensation hypotheses - always providing certain assumptions are accepted. In the case of the intellectualisation hypothesis, if it is accepted that SCE may serve to mollify potentially threatening dream experiences, then their pattern of spending a high proportion of REM sleep in REM-Q activity - and hence SCE - does suggest that divergers make considerable use of intellectual modes of defence. And, with respect to the compensation hypothesis, if it is accepted that sustained eye movement activity is reflected in the intensity of the associated dream experience - an assertion backed by evidence as strong as any relating physiological events to psychological experience - then convergers do display a pattern of eye movement activity indicative of more intense dream experience.

Duration of REM Sleep

As already indicated (Table 6.2), convergers spend longer than divergers in the first two REM periods of the night, whereas divergers spend significantly longer than convergers in the remaining REM periods of the night. Tentatively, these findings have been interpreted as providing support for the compensation and intellectualisation hypotheses, respectively. A closer inspection of the distribution of REM sleep throughout the night - by examining the time spent in individual REM periods - may serve to clarify the interpretation of these two findings. Firstly, the difference observed between convergers and divergers on the first two REM periods may assume statistical significance for one or other of the two REM periods under separate treatment. And if this difference should prove significant for the first REM period in particular - suggesting a convergent need for more immediate dreaming - then the compensation interpretation would be placed on still firmer ground. Secondly, this analysis will clarify the source of the difference between convergers and divergers in the time spent in REM sleep during the latter part of the night. For this difference may be attributable entirely to the divergent pattern of spending longer sleep (and therefore having more REM periods); in which case there would be no need to invoke intellectualisation in explanation. Alternatively, divergers may consistently spend longer in each of these later REM periods; if this is established, then this analysis will further substantiate the intellectualisation hypothesis.

Table 6.5 contrasts the duration of individual REM periods for convergers and divergers:

TABLE 6.5: DURATION OF INDIVIDUAL REM PERIODS - CONVERGERS AND DIVERGERS CONTRASTED

| | REM Periods* (mean duration in minutes) | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| **Original Expt.** | | | | | |
| Convergers | 14.0(n= 6) | 22.2(n= 9) | 22.1(n= 9) | 22.9(n= 7) | 17.3(n= 4) |
| Divergers | 7.5(n= 9) | 22.1(n=12) | 24.5(n=12) | 36.3(n=10) | 34.6(n= 6) |
| p(two-tailed) | .08 | n.s. | n.s. | .03 | n.s. |
| **Replication** | | | | | |
| Convergers | 12.9(n= 5) | 28.9(n= 8) | 20.5(n= 8) | 38.3(n= 8) | 24.8(n= 2) |
| Divergers | 9.4(n=10) | 22.1(n=12) | 35.4(n=12) | 41.4(n=12) | 19.6(n= 6) |
| p(two-tailed) | n.s. | .07 | .04 | n.s. | n.s. |
| **Overall** | | | | | |
| Convergers | 13.6(n=11) | 25.1(n=17) | 20.2(n=17) | 28.7(n=15) | 20.0(n= 6) |
| Divergers | 8.6(n=19) | 22.1(n=24) | 30.0(n=24) | 39.7(n=22) | 27.7(n=12) |
| p(two-tailed) | .09 | n.s. | .04 | .09 | n.s. |

* Once again, on nights where a first (and, in one case, a second) REM period was missed, subsequent REM periods were ranked as if the missed period had occurred. In the original study, those REM periods that may have been interrupted by traffic were included (see Appendix V1), but those that did not occur at all, rather than being scored zero, were excluded altogether from the analysis. The overall means were calculated, as before, from the individuals' averages, over both studies where applicable.

Probabilities were computed using a Mann-Whitney U Test.

For REM periods 1 and 2, and combining the data from both the original and replication studies, convergers spend significantly longer than divergers in the first but not the second REM period (although a similar trend is evident). In fact, in the original study, convergers spent almost twice as long, on average, in this first REM period. This is as predicted by the compensation hypothesis. However, a better indicator of the amount of 'essential' (unelaborated PVE) dreaming would seem to be the time spent in REM-M activity. This may be calculated by combining the duration of the first REM period with the eye movement profusion during this period (from Table 6.3). This combination reveals that convergers spend on average 2.59 minutes (77.7 two-second epochs) in REM-M activity during the first REM period in the original study; divergers, on the other hand, average only 0.90 minutes (27 two-second epochs) of REM-M activity during the first REM period. Indeed, there is no overlap whatsoever between convergers and divergers on this measure ($p < .002$, two-tailed, Mann-Whitney U Test). Convergers, then, experience far more phasic-related PVE during this first REM period, a finding that adds further strength to the compensation hypothesis.

Turning to the later REM periods, and once more combining the data from both studies, divergers spend significantly longer than convergers in both the third and fourth REM periods of the night. The length of the fifth REM period, on the other hand, did not differ consistently between convergers and divergers, but this period proved very erratic in length occurring as it does around morning arousal.[6] This, then, confirms the view that the greater amount of REM sleep experienced by divergers during the latter part of the night is not merely a function of spending longer asleep. Rather, this consistent pattern may reflect an increasing preoccupation, on the part of divergers, with intellectual activity, brought into play to handle the increasing volume of threatening material associated with later REM periods (Foulkes, 1966).

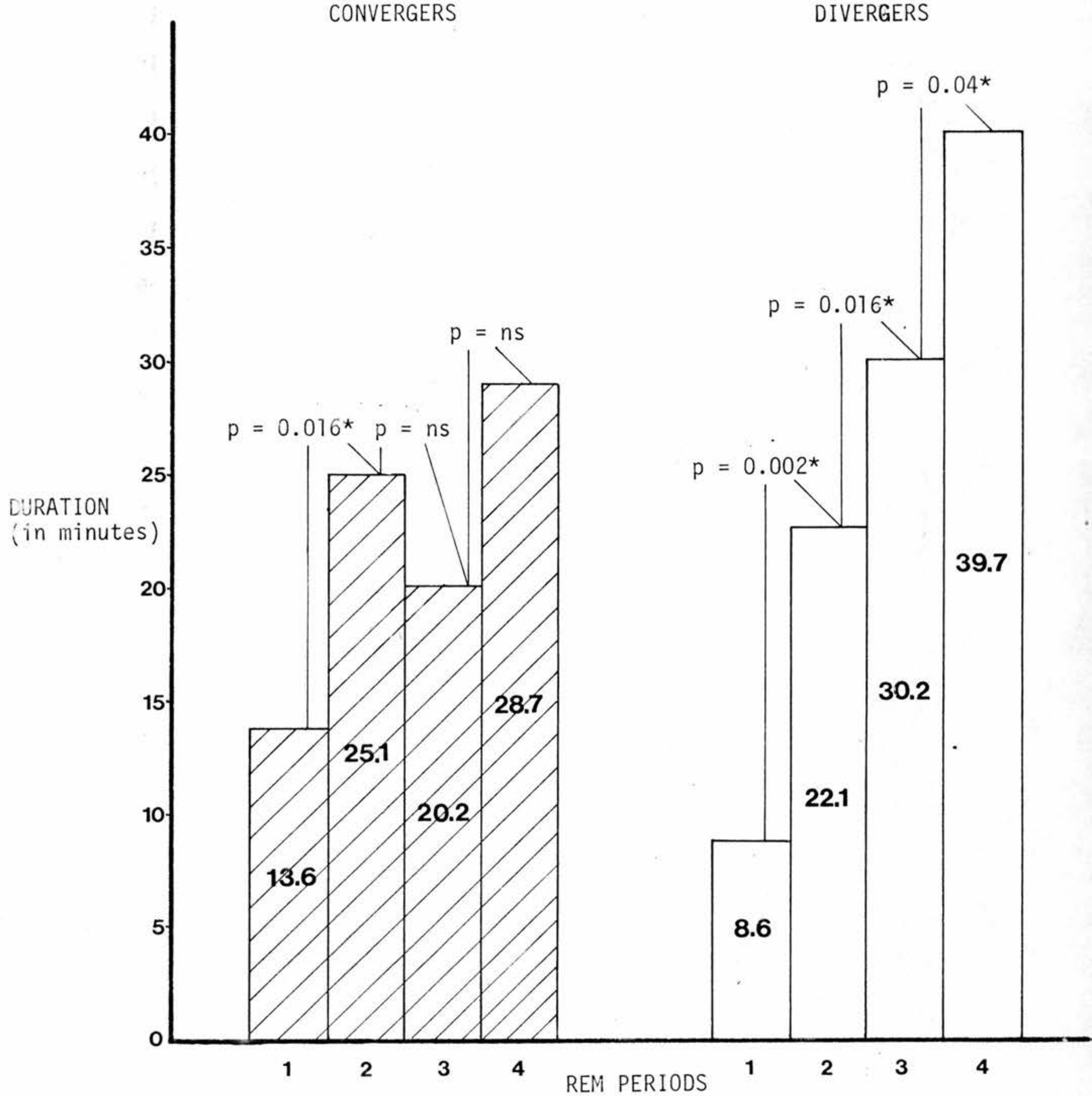
The durations of successive REM periods over the course of the night are mapped for convergers and divergers in Figure 6.2, and here too distinctive pictures emerge for the two groups. For the convergers, the duration of the second REM period significantly exceeds that of the first, but thereafter there is no notable increase.[7] For the divergers, however, there is a significant increase in the time spent in each successive REM period up to and including the fourth of the

6 Again, there are discrepancies between the original and replication studies during the later REM periods. Reasons for this are discussed in Appendix V1. The consequences of these discrepancies for the present analysis are also discussed in Appendix V1 where it is argued they do not significantly alter the findings.

7 However, if disrupted fourth REM periods in the original study are adjusted (see Appendix V1), the fourth REM period does exceed both the second ($p<.02$, two-tailed) and the third ($p<.03$, two-tailed) REM periods.

FIGURE 6.2

SUCCESSIVE REM PERIODS OF THE NIGHT - CONVERGERS AND DIVERGERS CONTRASTED (ORIGINAL AND REPLICATION DATA COMBINED)




* All significance levels are two-tailed; probabilities were computed using a Mann-Whitney U test

night.[8] Once again, these different patterns between convergers and divergers are best explained in terms of the increasing use of intellectualisation in parrying more threatening dreams as the night's sleep progresses. Convergers, in contrast, do not appear to require more time to express more threatening dreams which may be explained by their preference for repressing such material.

REM Latency

Table 6.1 demonstrated a trend, in both studies, toward convergers having a shorter REM latency than divergers.[9] In neither study was this a significant effect, however. But on several nights subjects missed their first REM period of the night and, on these occasions, REM latency was calculated from falling asleep

8 This remained the case even after the overall means of the third and fourth REM periods had been adjusted upwards to compensate for interrupted REM periods in the original study (see Appendix V1), although significance levels did alter: the significance level between REM periods 2 and 3 increased to .002 (two-tailed) and between REM periods 3 and 4 decreased to .09 (two-tailed).

9 REM latency refers to the interval between falling asleep and first entering REM sleep.

to the 'second' REM period (i.e., the first one expressed).[10] If these extended REM latencies are excluded from the analysis, then the difference between convergers and divergers on this variable assumes significance (Table 6.6), a finding predicted by the compensation hypothesis.

TABLE 6.6: REM LATENCY - CONVERGERS AND DIVERGERS CONTRASTED

| | Convergers | | | Divergers | | | p(two-tailed) |
|---|---|---|---|---|---|---|---|
| | Nights | Mean | Range | Nights | Mean | Range | |
| Original Expt. | 6 | 58.3 | 44-79 | 9 | 78.6 | 61-116 | .10 |
| Replication | 5 | 55.5 | 34-80 | 10 | 80.4 | 57-119 | .04 |
| Overall* | 11 | 57.6 | 34-80 | 19 | 79.7 | 57-119 | .04 |

* In cases where individuals participated in both studies (10 of the 12), their REM latencies were averaged over the two studies. As before, group means were calculated from these individual averages.

Probabilities were computed using a Mann-Whitney U Test.

10 These missed first REM periods occurred on 7 nights (4 convergent and 3 divergent) during the original study and on 5 nights (3convergent and 2 divergent) during the replication. Three convergers and 2 divergers each missed their first REM period on 2 out of 4 nights; and another converger missed 1 first and 1 second in the course of 3 nights. In other words, half of the subjects account for 12 of the 13 instances of missed REM periods. It may be that these missed REM periods reflect an adjustment made to bridge a discrepancy between the individuals' circadian rhythms and the constraints of a 24 hour day. If this is the case, some individuals' circadian rhythms appear more 'out of sorts' with the 24 hour schedule - and, therefore, require more frequent adjustment - than others.

Also consistent with the compensation hypothesis, although not specifically predicted, is the convergers' reaction to missed first REM periods. On each of the 7 occasions convergers missed a first REM period, a spontaneous awakening occurred. Moreover, on these nights with no first REM period, convergers tended to delay returning to deep sleep and appeared to make second and even third attempts to enter REM sleep, with each attempt again culminating in an awakening.[11] Divergers, on the other hand, did not wake during the period of 'light' sleep surrounding any of the 5 occasions on which they missed a first REM period. Divergers also returned to deep sleep more readily following a miss. This contrast may reflect a greater reluctance on the part of convergers to forego their first REM period of the night, even to the extent of, on one occasion, apparently delaying the miss until the second REM period, a most unusual occurrence: and, when the first REM period is missed, convergers respond by waking which may reflect anxiety on their part. In other words, on this interpretation, convergers are again displaying a greater need for REM sleep, and presumably dreaming, than divergers: not only do they tend to enter REM sleep earlier in the night's sleep, they are also more disturbed by the loss of the first opportunity to do so.

11 There was a solitary exception.

TABLE 6.7: A SUMMARY OF THE DIFFERENCES IN REM SLEEP PATTERNING OBSERVED BETWEEN CONVERGERS AND DIVERGERS

| REM Sleep Characteristics | Typical Convergent Pattern | Typical Divergent Pattern |
|---|---|---|
| REM sleep latency | short[A] | long |
| Length of REM sleep over whole night | short | long[B] |
| Length of first REM period | long[A] | short |
| Length of later (third and succeeding) REM periods | short | long[B] |
| Eye movement profusion during first REM period | high[A] | low |
| Eye movement profusion during later REM periods | high[A] | low[B] |

[A] Patterns suggesting a need for immediate and intense dream experience on the part of convergers.

[B] Patterns suggesting the use of intellectualisation on the part of divergers.

# PART 1V

# CHAPTER 7

## IN PROSPECT

The primary concern of this dissertation has been the experimental investigation of the hypothesis that different defensive orientations underpin convergent and divergent thinking. And the findings in this direction have added substance to Hudson's suggestion that divergers are more likely to use intellectual strategies of ego-defence, whereas convergers more typically resort to repression. In addition, convergers displayed every indication of a greater need to dream than divergers, suggesting that they compensate for their drive-repressing day during the night. The research has also highlighted a promising new research tool, namely the psychological distinction between tonic and phasic features of REM sleep.

At a theoretical level, the confirmation of contrasting defensive orientations in convergent and divergent thinkers has bolstered Hudson's developmental model outlined in Chapter 1. In view of this early flush of success, the model merits closer attention. This finding is not only of theoretical interest, however. Above all else, it emphasises that to think in a convergent or divergent manner is no mere conscious choice.

The ways in which we think, as much as any other personal attribute, spring from deep-seated needs and reflect the adjustments we have made in seeking some sort of balance for our personalities. To tamper with our cognitive style once set is to tamper with this balance. Yet the educational process often does just that. For education is never value-free. Albeit unintentionally, the teacher brings to his students an approach rooted in tradition and enriched with strong personal preference. Little wonder that those that survive the initiation rites of specialisms share much in common. The straitjacketing is personal. To fail to identify will not only be uncomfortable in a personal sense, it will also increase the likelihood of academic failure. The few who do persevere in an antagonistic academic environment may intensify their defences and cope. But, beyond a certain point, defensiveness becomes counter-productive not to say maladaptive. Perhaps this system is effective in weeding out students unsuitable for a particular discipline. However, to be an academic misfit, in the sense used here, need not necessarily lead to an unsuccessful career in that field. Are we in fact removing individuals different enough to add something new to their discipline?[1] We do not know and without a change in educational approach we will not find out.

1 It is striking how often major contributions are made by individuals who have been both uninspiring as students and quite unlike their academic colleagues (e.g., Charles Darwin, Albert Einstein and Francis Crick).

Turning to dreaming, does this research add anything to our understanding of the dream? Certainly, many would be dissatisfied with the manner in which dream experience has been handled in this thesis: laboratory man at his insensitive best quantifying away the richness and variety of the dream experience itself. Even where phenomenal aspects have been broached, attention has been steered away from the detail of the dream content in favour of the dream's formal expression. However, this treatment reflects the nature of the research design rather than any underlying commentary on the quality of the dream experience. Indeed, the exploration of defensive mechanisms within the context of dreaming implies that the dream has psychological significance in its own right: one does not, after all, defend against meaningless chatter.

Despite this apparent neglect of the dream as a psychological entity, this research does have something to offer dream theory. The contrast struck between PVE and SCE serves to emphasise the non-rational source of dreams. In Molinari & Foulkes' terms, "PVE bears the stamp of an eruption from the unconscious". At any rate, PVE is quite unlike thought worked on at a conscious level: it seems to arrive in the conscious fully-formed. This contrast between PVE and SCE - the switch within the dream from primary process thought to secondary process thought - is unmistakable; and the difference in their formal properties lends credence to the idea that dreams are launched from unconscious, non-rational sources.

This view, of course, is not unique to Freudian dream theory. Of more particular comfort to protagonists of Freud's theory is the observation that convergers have more immediate and more intense dreaming (REM sleep) as this suggests, quite forcefully, that dreaming compensates for the repressions of drive that convergers practice as a matter of habit during the day. The evidence thus supports Freud's central theme - that dreams provide an outlet for 'wishes' not expressed by day. This finding is also consonant with Jung's more specific suggestion relating to the compensatory function of the unconscious: namely, that a dream can serve as a counterbalance to the attitude a person consciously holds.

The notion that both repression and secondary revision is used in handling anxiety-provoking manifest dream content is also well supported. In one respect, however - and it is a crucial one - the remarkably high incidence of convergent dream recall failures attributed here to repression would seem to challenge psychoanalytic theory. Freud suggested that it is the function of manifest dreaming to conceal the unacceptable. Why, then, should the converger repress when he has, if Freud is right, already concealed the threatening ideas under more trivial ones? One way round this interpretative puzzle is to adopt the Jungian viewpoint: to claim that the language of dreams, although symbolic and difficult to understand, does not attempt to conceal anything.

An alternative explanation - and one which retains the function of the 'dream-work' - focuses on the question of what is and what is not acceptable. Freud was referring to the specific content of dream-thoughts which would be 'painful' if made too explicit in the manifest dream. And it was in his view the task of the 'dream-work' to disguise such 'wishes' in the dream experience. However, if what is unacceptable to the converger is not just the specific content of his painful dream-thoughts but the whole shadowy underworld of primary process mental functioning over which he can exert no conscious, rational control - the world on which dreams draw - then the poor levels of recall that convergers display make good sense. Certainly, the spontaneous comments offered by convergers following a failure to recall after a REM-M awakening (see Chapter 5) suggest a general uneasiness over the nature of the dream experience as much as any reaction to the specific content of the dream. And much of the evidence marshalled in Chapter 1 suggests a pervasive alienation on the part of convergers from their own emotional workings: overtly, these are denigrated as meaningless and without value; covertly, they seem to be perceived by convergers as profoundly disturbing. On this argument, then, PVE - the primary process intrusion - represents a potential threat not only through its specific message but also by making the converger aware of his own 'alien' mental world and its power. SCE, in contrast, offers the converger the security of orderly, rational secondary process thought.

If this point of view is accepted, there still remains one important doubt. For if it is the primary process thought as such that the converger needs to defend himself against, why does the converger recall any material from REM-M awakenings at all? The result one would predict from such an interpretative stance is that the convergers' recall from REM-Q awakenings would be excellent (as it is), but that the rate of recall from REM-M awakenings would be very much lower than the 50% observed. What is needed, in other words, is some means of distinguishing - within primary visual experience - between the ideas or images likely to create great anxiety among convergers and those likely to create relatively little anxiety.

Fortunately, there is a practical method for investigating such differences - although one that lies outside the scope of the present inquiry. This would make use of a sample in which all degrees of convergence and divergence were represented, rather than extreme groups only. It should then be possible to identify, by means of a content analysis of the dreams reported, certain types of content which are acceptable to moderate convergers but not to extreme convergers; and, similarly, of course, types which are acceptable to all-rounders and mild divergers, but which mild convergers appear to block or forget. Such a project could not exclude definitively the possibility that convergers have different sorts of dream from divergers; nor that their tendency to forget might be caused not by the dream's content but by some other more superficial consideration - for instance, the interference created by the individual's mental activity on first waking up. Such rival explanations make no reference to psychodynamic processes, and to that extent might be thought attractive. On the other hand, they do not accommodate the full range of evidence now available: in particular the fact that convergers display greater profusion of REMs - a finding that fits naturally into the psychoanalytic frame of reference, but renders any of its apparently more parsimonious rivals strained to the point of unacceptability.

One consequence of such research, then, is to remove the notions of repression and of the unconscious from the centre of attention; and to replace these with the distinction, equally vital to the Freudian corpus, between primary and secondary process thought - both of which lie within the sphere of consciousness, and which, strictly speaking, are suppressed or forgotten rather than repressed. What is at stake, as far as the differences between convergers and divergers are concerned, is less the curtailing of consciousness by draconian and repressive means; more the maintenance of a boundary between two types or modes of thought - one intuitive and immediate, the other more rational-seeming and sustained.

Finally, this study has something to offer future research into sleep and dreaming. The linking of REM sleep patterning with personal differences, in particular, prompts exciting new avenues. For, on the basis of other research, we now know that we have the means of manipulating the patterning of REM sleep by pharmacological/ dietary means.[2] What psychological effects would this have? Would the effects differ for different personalities? One intriguing possibility would be that of modifying personality by changing REM sleep patterning. If, for example, intensifying REM sleep intensifies drive expression in dreams (for which there is considerable support, e.g., Evans & Oswald, 1966), what effect, if any, would this have on waking behaviour? Can we make the converger more or less convergent? The aggressive more or less aggressive? The over-eater, the smoker or the drinker worsen or moderate his intake? Alleviate schizophrenic or depressive symptoms? Finally, studies with women may prove fruitful in this context. For the caprices of the menstrual cycle, of going on and off

2 These studies are discussed in Appendix V11.

contraceptive pills and of pregnancy may all signal changes in the patterning of REM sleep.[3]

This study, then, has posed more questions than it has answered. Many we had not previously thought to ask; and the answers promise to be of practical as well as theoretical concern. What is now needed is research of an interdisciplinary nature that will allow us to link together the various levels of biological and psychological functioning that make up the human condition: biochemical events; physiological expressions such as the menstrual cycle and REM sleep patterning; mental experience, whether by day or night; and the diverse aspects of life-style, ranging from occupational choice to diet. It is doubtful whether large-scale correlational studies will prove helpful in this context: gross averages will tell us little about the individual. What is sought is a closer examination of the relationship between these different levels of functioning, individual by individual.

3 On the evidence of the little research that has been done in this area, Hartmann (1966a) found an increase in REM sleep (eye movement profusion was not measured) during ovulation and premenstrually, especially in those with premenstrual tension. More recently, Ho (1972) has found no increase in REM sleep premenstrually in women without symptoms of premenstrual tension. Hartmann also reported more REM sleep on than off a contraceptive pill (Enovid). Neither of the above increases in REM sleep were associated with changes in total sleep time. These increases fit the biochemical argument advanced in Appendix V11 as both oestrogen and progesterone influence the rate of turnover of brain serotonin (Rose, 1969; Tonge & Greengrass, 1971; Ladisich, 1974). It is tempting to link psychological changes such as premenstrual tension, loss of libido on the contraceptive pill and postnatal depression with shifts in REM sleep patterning.

# APPENDICES

# APPENDIX 1 :

## THE OPEN-ENDED TESTS

## MEANINGS OF WORDS

Each of the five words below has more than one meaning. Write down as many meanings for each word as you can.

(1) Bolt.

(2) Fast.

(3) Pitch.

(4) Sack.

(5) Tender.

## USES OF OBJECTS

Below are five everyday objects. Think of as many different uses as you can for each.

(1) A barrel

(2) A paper clip

(3) A tin of boot polish

(4) A brick

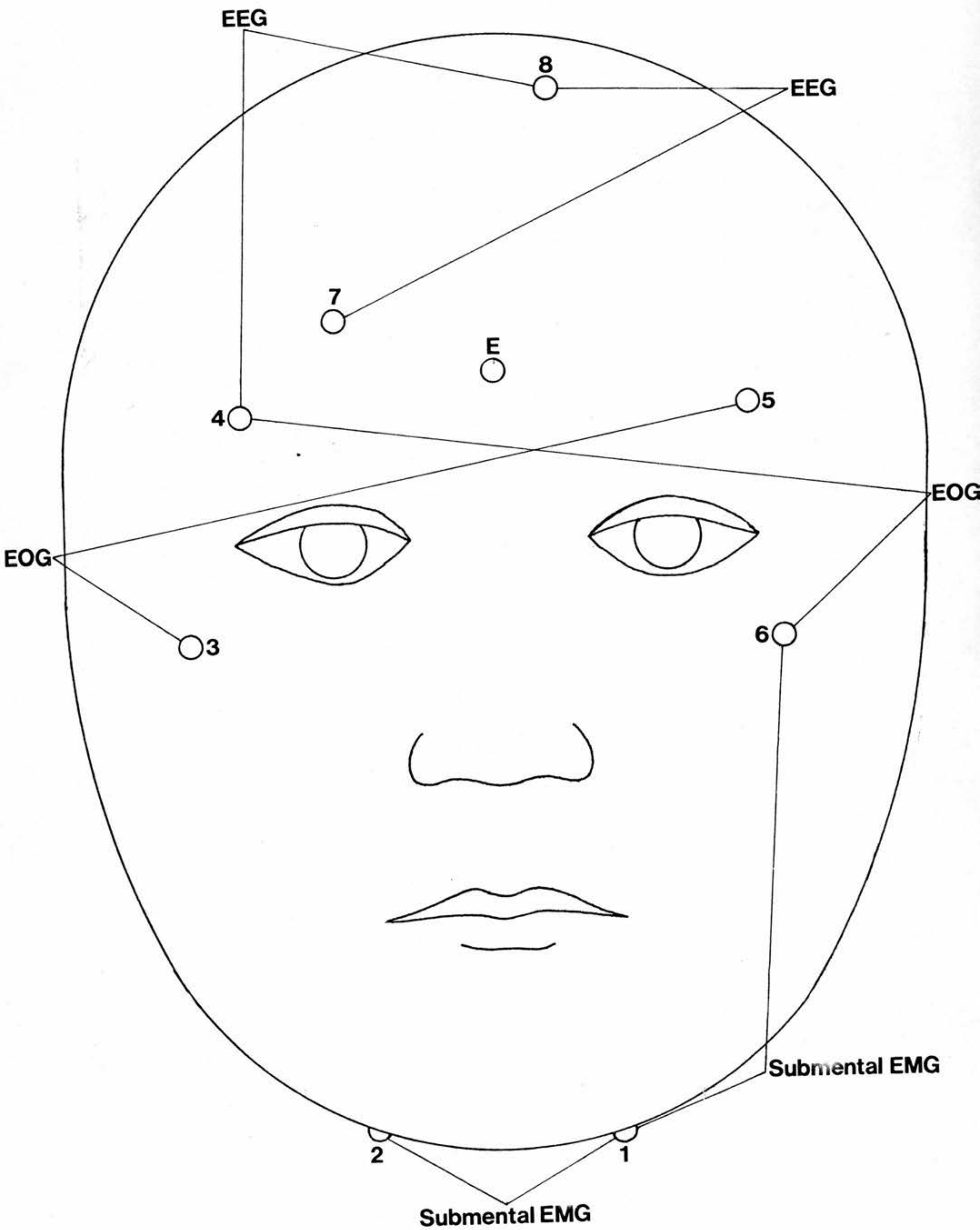
(5) A blanket

# APPENDIX 11 :

## ELECTRODE PLACEMENTS

FIGURE II.1

ELECTRODE PLACEMENTS

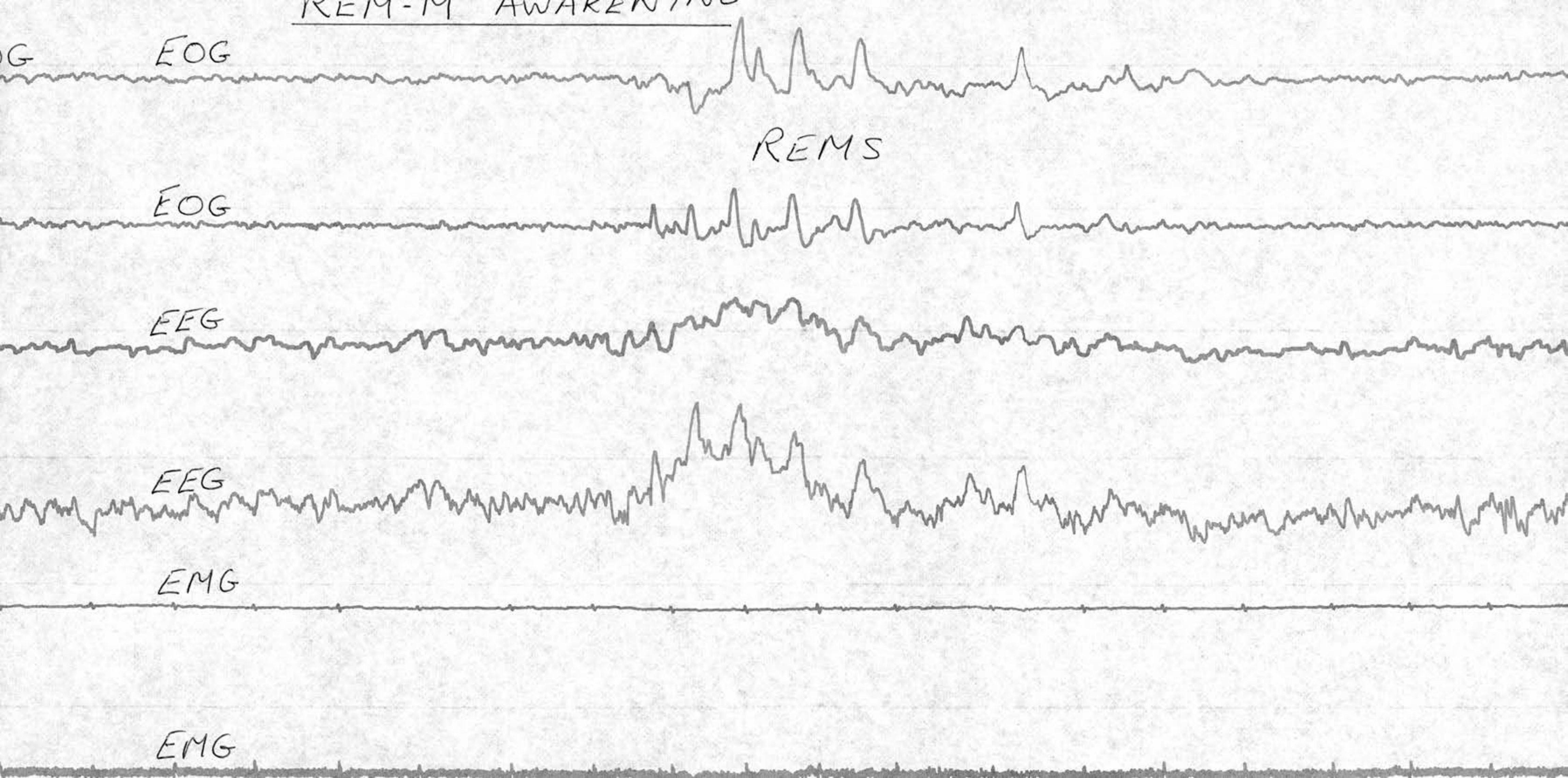


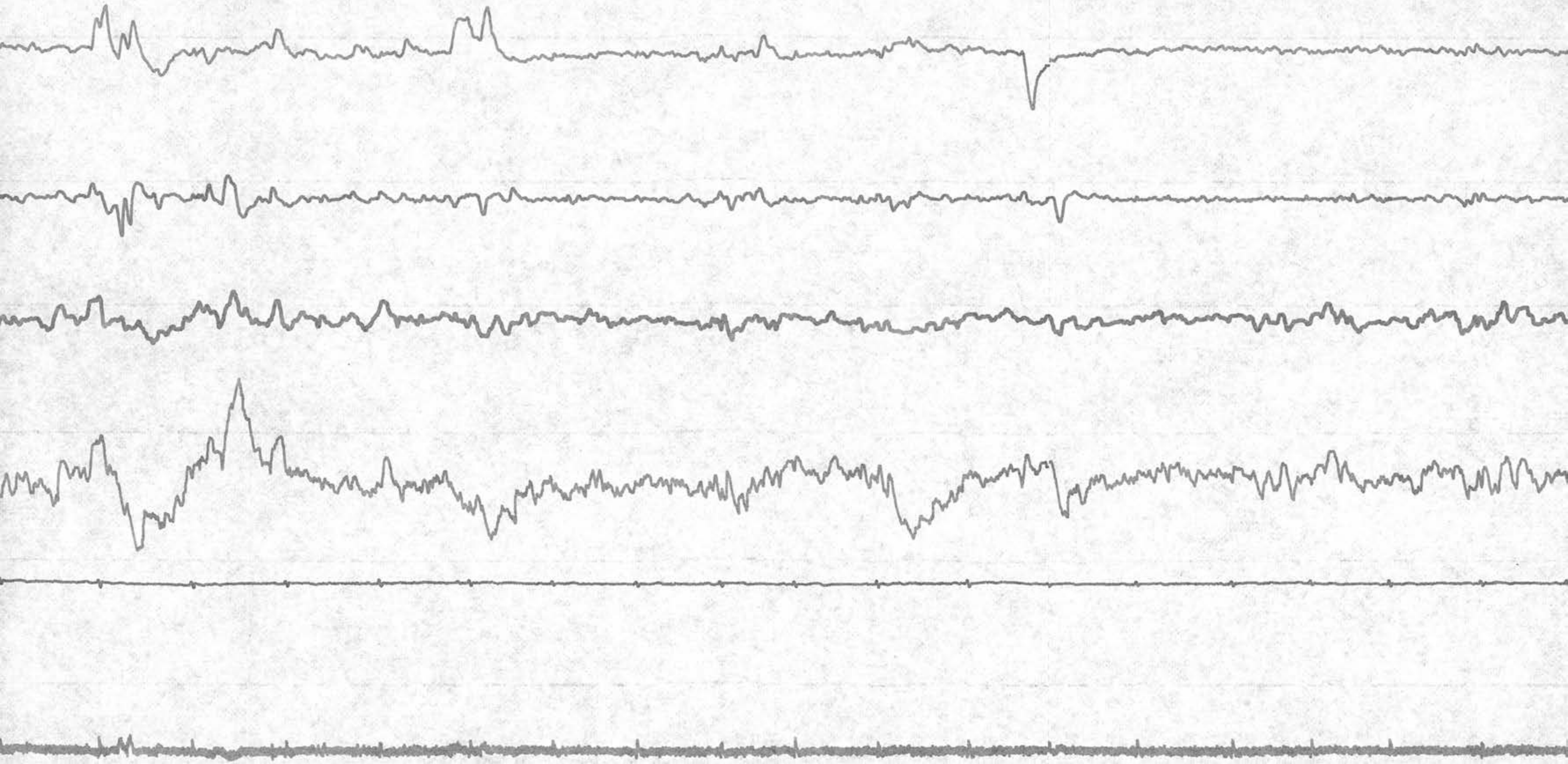
Electrode Placements.

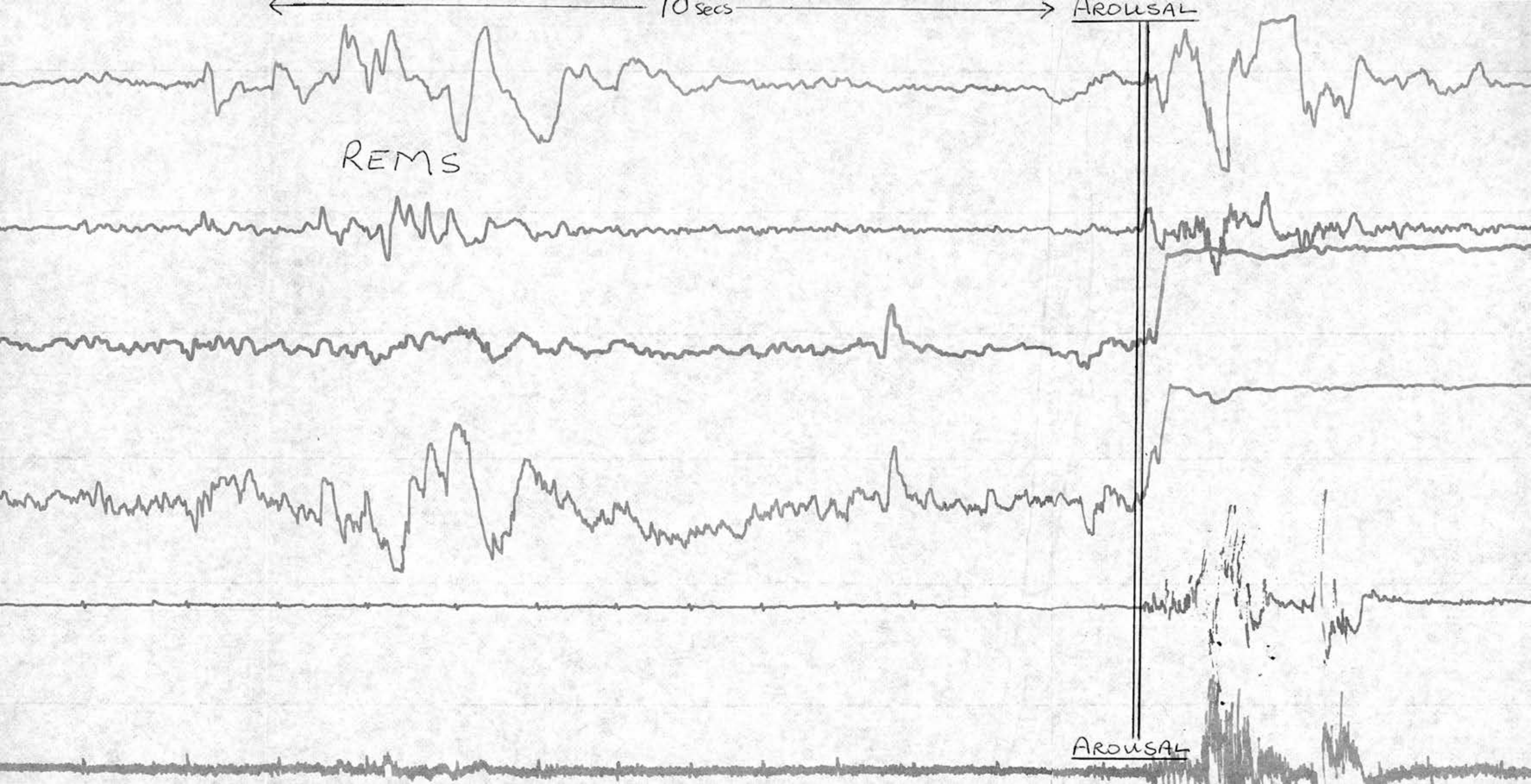
Six channels were used for each subject. Potential differences were recorded between the following pairs of electrode placements: 3-5 and 4-6 (EOG channels); 7-8 and 4-8 (EEG channels); 1-2 and 1-6 (submental EMG channels). Using 2 channels for each electrophysiological variable lessened the chance of losing one of the variables through a faulty electrode connection developing during the course of the night. Despite this, if electrodes 1 or 8 loosened, this could still lead to interference on both EMG or EEG channels. Where interference occurred, it could be rectified by switching from the faulty electrode to another suitable one. For example, if electrode 7 developed a fault, the 7-8 EEG channel may be switched to 5-8. Detecting the faulty electrode is a simple matter as, with one exception, one of the electrodes is always represented in another channel. Clearly, if an electrode represented in two channels is faulty both channels experience interference; and if this is not the case, then the other electrode is at fault. In one of the EOG channels, 3-5, neither electrode appears on another channel. In this case, the faulty electrode is determined by combining both electrodes, in turn, with a third and observing which combination still gives interference. In 'mixed' EEG and EMG channels using one eye electrode - 4-8 and 1-6 - eye movements picked up on these channels could be discounted by referring to the simultaneous EOG tracing.

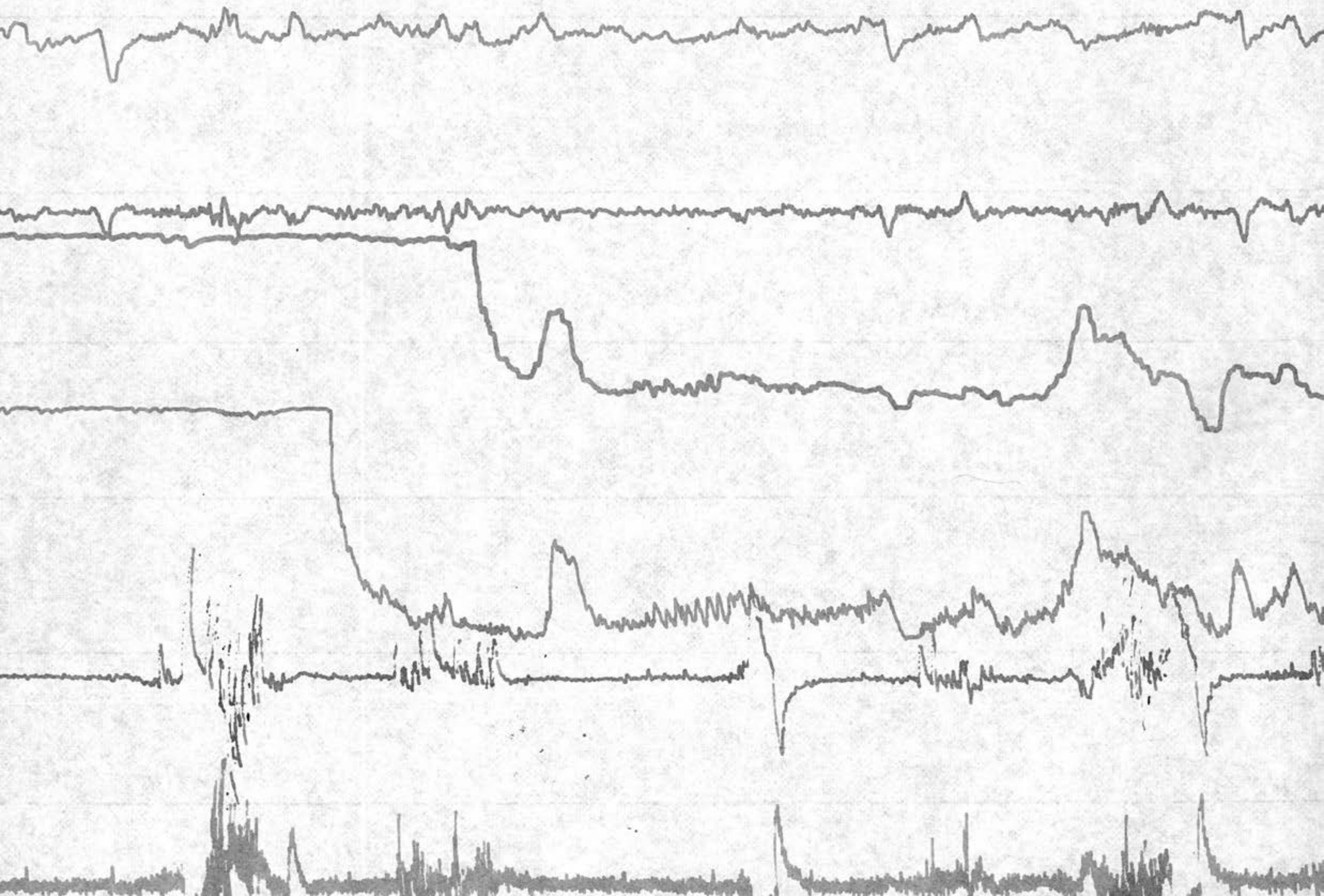
# APPENDIX 111 :

## REM-M AND REM-Q AWAKENINGS

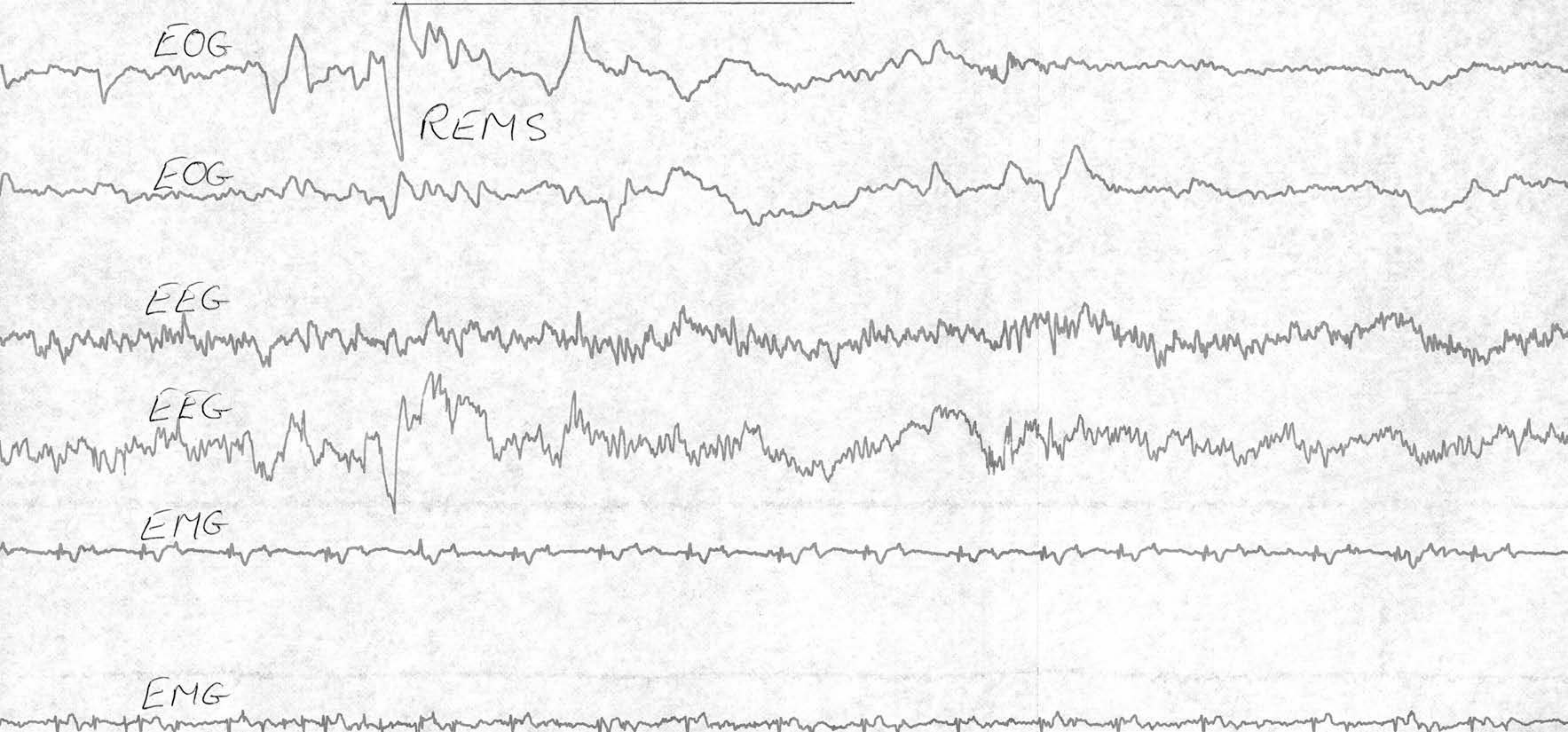

REM-M
EOG
REMS
EOG
EEG
EEG
EMG
EMG

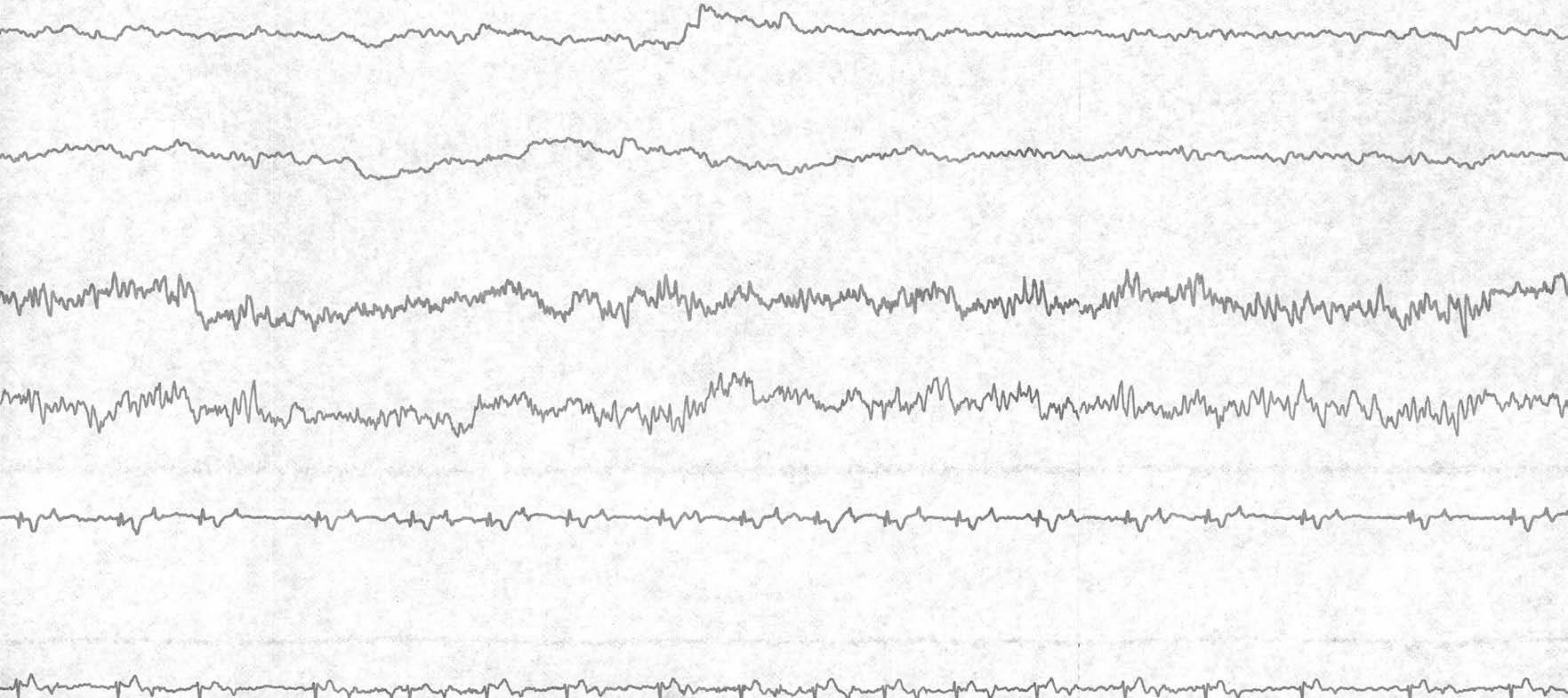



10 secs
AROUSAL
REMS
AROUSAL



# REM-Q AWAKENING





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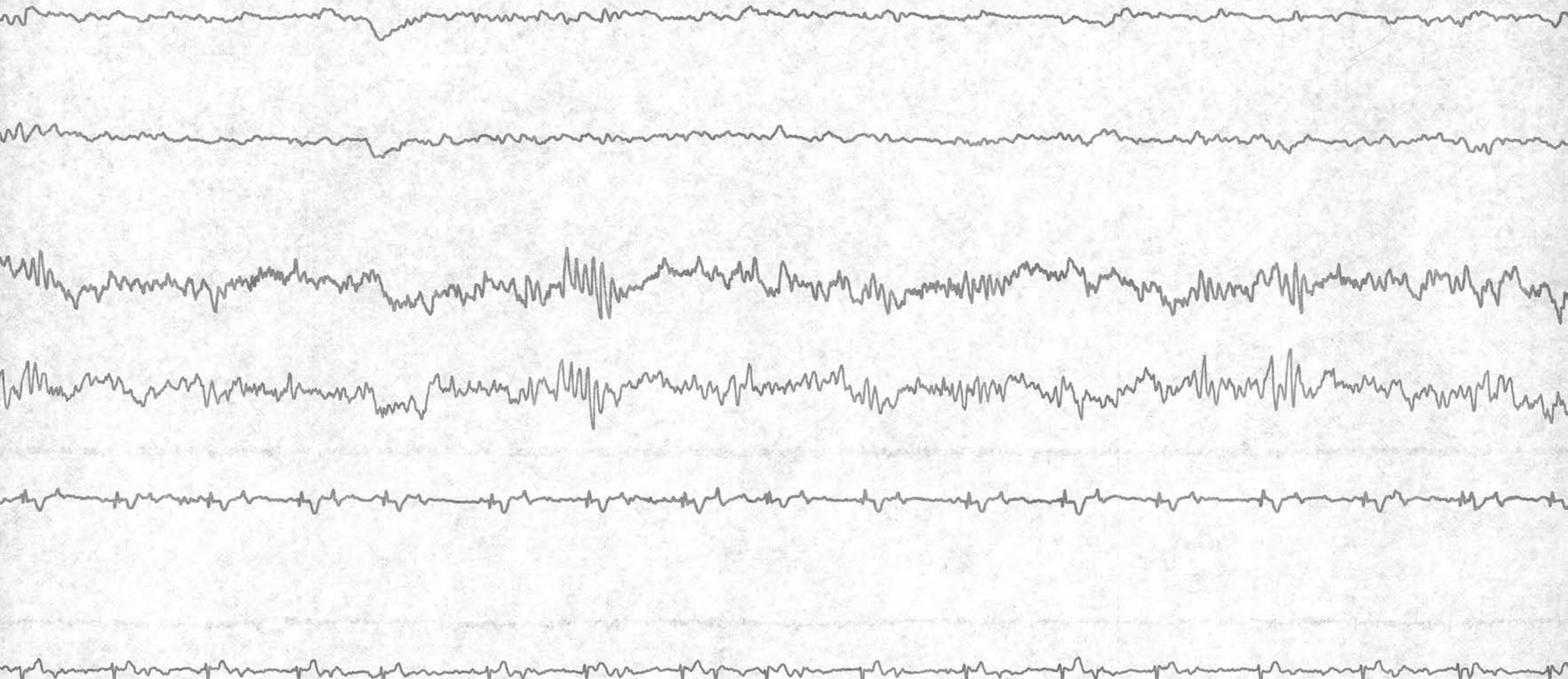

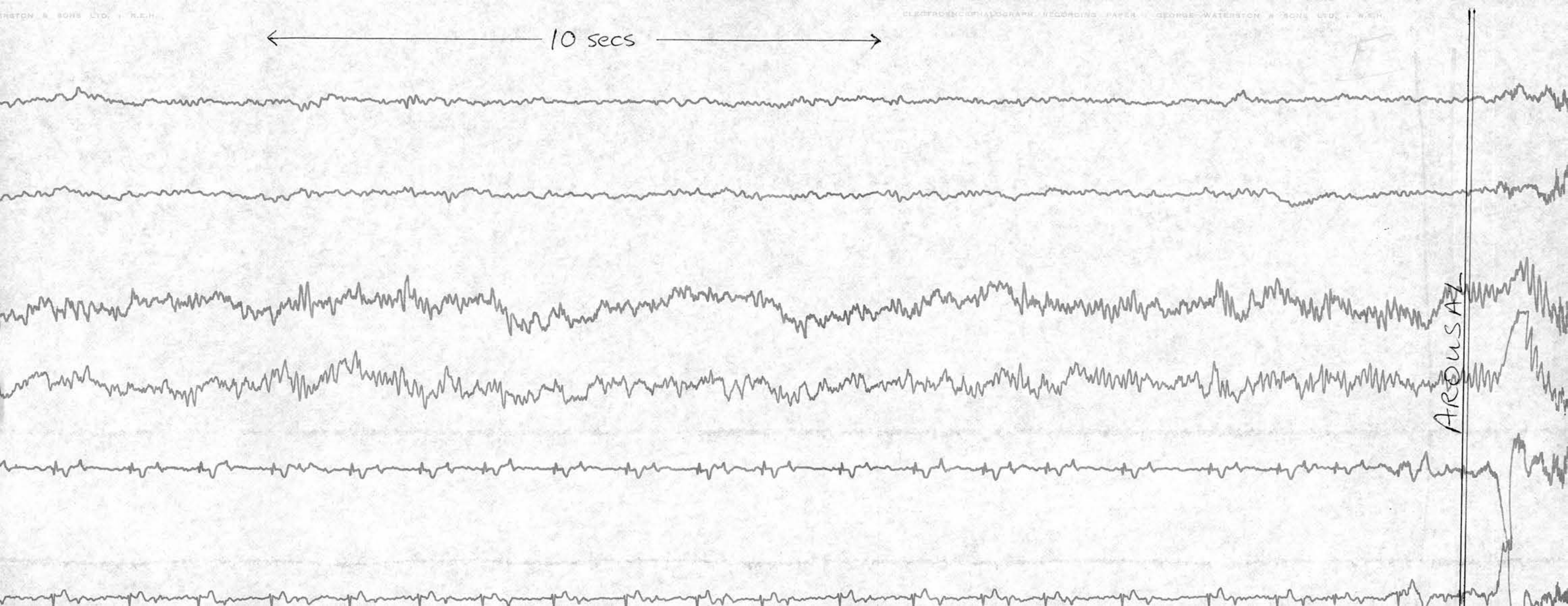
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# APPENDIX 1V :

## LENGTH OF DREAM REPORTS BY ACADEMIC DISCIPLINE

TABLE 1V.1: MEAN NO. OF WORDS OF DREAM REPORTS BY ACADEMIC DISCIPLINE

| | Fine Art | Architecture | Engineering | p*(two-tailed) |
|---|---|---|---|---|
| All wakings | 47.9 | 89.2 | 64.1 | n.s. |
| REM-M wakings | 52.5 | 88.8 | 61.3 | n.s. |
| REM-Q wakings | 45.1 | 94.7 | 63.3 | n.s. |
| Diff. between REM-M and REM-Q wakings | +7.4 | -5.9 | -2.0 | n.s. |

*Kruskal-Wallis one-way analysis of variance (Siegel, 1956).

Within both fine art and architecture groups, convergers and divergers follow their respective group tendencies; and the anomalies in the engineering group (see Chapter 5) appear to cancel each other out. As a result, no distinguishing trend in the difference between REM-M and REM-Q-related dreams emerges from any of the academic disciplines. The architecture group appear to produce much longer dream reports following both REM-M and REM-Q awakenings, but this is entirely attributable to the performance of two of the four subjects in this group, one converger and one diverger.[1]

1 The two architects who reported their dreams at length in fact both averaged over 120 words per dream from all awakenings but still conformed with their respective cognitive style groups on difference scores: the converger had a difference score of +20.5; the diverger a difference score of -37.0.

# APPENDIX V :

## LENGTH OF DREAM REPORTS BY OPEN-ENDED TEST PERFORMANCE

TABLE V.1: MEAN NO. OF WORDS OF DREAM REPORTS BY OPEN-ENDED TEST PERFORMANCE

| Open-Ended Test Scores | All Wakings | REM-M Wakings | REM-Q Wakings | Diff. between REM-M and REM-Q Wakings |
|---|---|---|---|---|
| -1.0 | 50.8 (n=27) | 55.9 (n=13) | 40.5 (n=14) | +15.4 |
| -0.5 | 27.2 (n= 5) | 44.0 (n= 2) | 16.0 (n= 3) | +28.0 |
| 0.0 | 91.0 (n=13) | 95.7 (n= 8) | 92.4 (n= 5) | + 3.3 |
| +0.5 | 64.9 (n=19) | 58.5 (n= 9) | 69.1 (n=10) | -10.6 |
| +1.0 | 122.3 (n= 3) | 110.0 (n= 2) | 147.0 (n= 1) | -37.0 |
| +2.0 | 69.4 (n=14) | 54.4 (n= 9) | 96.6 (n= 5) | -42.2 |

The length of dreams collected from REM-M awakenings follows no particular trend. The pattern following REM-Q awakenings is also rather erratic; although, if the highest, middle and lowest open-ended test categories are paired, the length of dreams collected from REM-Q awakenings does increase along with open-ended test performance. The most striking and consistent finding, however, concerns the difference scores between dreams collected from REM-Q awakenings relative to those collected from REM-M awakenings.

As some success was achieved in matching open-ended test performance for the convergent and divergent groups, the data presented in Table V.1 appear, at first glance, to contradict the earlier conclusion (from Table 5.5) that the pattern of relatively longer dream reports following a REM-Q awakening is a divergent trait: it seems as if this pattern is at least as well accounted for by open-ended test performance *per se*. Under closer scrutiny, however, this apparent contradiction dissolves: for the lowest open-ended performance categories (-1.0 and -0.5) are found, for the most part, to reflect convergent dream reporting (3 convergers, 1 diverger); the middle range open-ended categories (0.0 and 0.5) reflect both convergent and divergent dream reporting equally (2 convergers and 2 divergers); and the highest levels of open-ended test scoring (+1.0 and +2.0) reflect exclusively divergent dream reporting. In other words, the matching of open-ended test performance and convergence/divergence has, on this occasion, broken down. This is attributable to the exclusion of 2 subjects - 1 converger and 1 diverger - who failed to provide any dreams from REM-Q awakenings and, therefore, difference scores.

While we may have resolved the apparent discrepancy between Table 5.5 and Table V.1, we are no nearer separating the relative influences of convergence-divergence and open-ended test performance on the dream difference scores. In an attempt to clarify the picture, individual difference scores were contrasted for convergence/divergence (both overall and relative to the individual's academic group) and open-ended test performance (Table V.2A) and the correlations between the different variables computed (Table V.2B).

TABLE V.2: DREAM DIFFERENCE SCORES - CONVERGENCE/ DIVERGENCE AND OPEN-ENDED TEST PERFORMANCE CONTRASTED

A. Individual Scores

| Diff. Score | Overall con/di. | Con/di. rel. acad. gp. | Open-ended Scores |
|---|---|---|---|
| +34.8 | extreme converger | extreme converger | -1.0 |
| +28.0 | moderate converger | extreme converger | -0.5 |
| +20.5 | extreme converger | extreme converger | 0.0 |
| + 6.6 | moderate converger | moderate converger | -1.0 |
| + 4.6 | moderate diverger | moderate diverger | -1.0 |
| + 4.4 | moderate diverger | extreme diverger | +0.5 |
| -14.0 | extreme diverger | moderate diverger | 0.0 |
| -25.7 | moderate converger | mod. con./all-rounder | +0.5 |
| -37.0 | extreme diverger | extreme diverger | +1.0 |
| -42.2 | extreme diverger | extreme diverger | +2.0 |

B. Intercorrelations of the variables (Spearman rank correlation)

| | Diff. Score | Overall con/di. | Con/di. rel. acad. gp. |
|---|---|---|---|
| Overall con/di. | .81* | | |
| Con/di. rel. acad. gp. | .83* | .88* | |
| Open-ended score | .75* | .57** | .67** |

$*p<.01$; $**p<.05$

From Table V.2A, it is evident visually that the difference scores correspond to a high degree with both measures of convergence/divergence. The one exception is, once again, the convergent engineer who is only marginally convergent relative to other engineers. The open-ended scores, on the other hand, correspond generally to a lesser extent with the difference scores: although the renegade convergent engineer's difference score does fit his open-ended performance rather better.

These impressions are confirmed in the correlation matrix (Table V.2B). Both convergent measures fit the difference scores more closely than do the open-ended scores, although the difference is not great. If the marginal convergent engineer is excluded, the correlations between the overall and academic group assessments of convergence/divergence and the dream difference scores increase to .92 and .88 respectively, while the correlation between open-ended test performance and difference scores remains unchanged (.76). However, the association between convergence/divergence and open-ended test scoring - despite the attempt to reduce it - makes it impossible to distinguish, in this analysis, any independent effects of open-ended test performance and convergence/divergence with any degree of certainty.

# APPENDIX V1 :

## DURATION OF REM SLEEP IN THE ORIGINAL AND REPLICATION STUDIES

There was some discrepancy (see Table 6.1) between the original and replication studies in the amount of time spent in REM sleep, even when - as in the divergers' case - total sleep time did not alter: both convergers and divergers spent more time in REM sleep during the replication. It is possible that the author, in the original analysis, applied stricter criteria to the scoring of REM sleep, particularly with regard to 'ambiguous' REM sleep (see section on data analysis in Chapter 4), but this could not account for much of the observed discrepancy. Moreover, the difference between the two studies occurred during the latter part of the night (see Table 6.2) when ambiguous REM sleep is rare. However, the studies did differ in another respect toward the end of the night. During the running of the first 6 subjects (3 convergers and 3 divergers) in the original experiment, subjects were sometimes disturbed, toward morning, by traffic on its way to the hospital kitchens nearby. Subsequent rerouting removed this potentially disrupting influence. While not necessarily waking the subjects, this traffic may have disrupted REM sleep. Certainly, on one or two occasions, the experimenter had observed a subject shifting out of REM sleep following traffic noise.

In order to clarify this question, the recordings of the 4 subjects (1 converger and 3 divergers) who experienced the traffic in the original study and who also participated in the traffic-free replication were compared over the two conditions. As the disturbance occurred between the hours of 5.30 a.m. and 6.30 a.m., any REM periods completed during this hour, as well as any REM periods that should have (but had not) occurred, were noted and compared with comparably ranked REM periods from the same individual recorded during the replication.

On the first baseline night in the original study, the converger had no third or fourth REM period and in fact awoke shortly after 5.30 a.m. and did not return to sleep;[1] on the other baseline night, this subject completed a third REM period of 32.3 minutes before 5.30 a.m. but had no fourth REM period. In the replication, by way of comparison, this subject had third REM periods of 29.7 and 33.0 minutes and fourth REM periods of 45.0 and 43.3 minutes. In this case, it looks as if the traffic disturbance has robbed this converger of 3 REM periods totalling some 120 minutes of REM sleep over the course of two nights. One diverger also had no fourth REM period on one baseline night during the original study and, on the other night, a fourth REM period lasting 20.7 minutes that finished before 6.30 a.m. In contrast, in the replication this diverger had fourth REM periods lasting 53.3 and 49.3 minutes. A second diverger had briefer and less consistent third REM periods during the original study (21.7 and 16.7 minutes) -

1 On this night, the converger had only 5 hours 51 minutes of sleep. This compared with sleeping times of at least 7 hours 10 minutes on his other 3 baseline nights. If this night is excluded, the 4 convergers who participated in both studies slept an average of only 10 minutes longer in the replication (c.f. Table 6.1).

both started before, but completed after, 5.30 a.m. - than during the replication (39.3 and 38.0 minutes). The third diverger followed a similar pattern on one baseline night in the original study, completing a third REM period of only 8.7 minutes shortly after 5.30 a.m., as against third REM periods of 31.7 and 39.0 minutes in the replication.

These instances certainly suggest that the traffic did disrupt some periods of REM sleep during the original study. Moreover, the consistent duration of REM periods within individuals on traffic-free nights encourages one to assess the loss of REM sleep incurred on disturbed nights. If the differences in the above-mentioned REM periods are calculated, in the divergers' case these alone account for the whole difference between the two studies in amount of REM sleep. With the convergers, of course, no such calculation could be attempted as 2 of the convergers who experienced the traffic did not participate in the replication and, as a result, no direct comparison between nights with and without the traffic disturbance could be made. Nevertheless, scrutiny of these 2 convergers' tracings does suggest that both were affected by the disturbance: in one subject, a 15 minute fourth REM period completed between 5.30 a.m. and 6.30 a.m. on one night as against a 30 minute fourth REM period completed after 6.30 a.m. on the other; in the second subject, a fourth REM period of just 7 minutes occurring between 5.30 a.m. and 6.30 a.m. on one night and no fourth REM period at all on the other night.

It seems, therefore, that REM sleep was affected on no less than 5 of the 6 baseline nights that each group experienced traffic. On one of the convergent baseline nights sleep was severely disrupted and this may account for the larger discrepancy in both total sleep time and REM sleep between convergers and divergers in the original study than in the replication (Table 6.1). If the assessed loss of REM sleep arising out of this one night is credited to the converger concerned, the difference in amount of REM sleep during the latter part of the night between convergers and divergers drops from 30.0 minutes to 23.9 minutes in the original study, as against a difference of 21.1 minutes in the replication. If the convergent group did lose, by virtue of this one night, more REM sleep than the divergent group during the original study, then the replication study may provide a more valid comparison of the amount of REM sleep experienced by convergers and divergers during the latter half of the night: and, even here, there is an equally significant, if smaller, difference. It seems reasonable to conclude that the presence of the traffic in part of the original study does not invalidate any overall comparison between the two groups: the traffic was experienced by an equal proportion (50%) of convergers and divergers and, with the exception of one night, both groups appear to have been affected to a similar extent, at least as far as the loss of REM sleep is concerned.

However, while both groups seem to have lost a similar amount of REM sleep overall as a result of the traffic disturbance, it is still possible that the two groups may have been differentially affected during the third and fourth REM periods when these are looked at individually. If this proves the case, it may invalidate the conclusion (from Table 6.5) that third and fourth REM periods of the night are longer for divergers than convergers - a finding taken as additional support for the use of intellectualisation on the part of divergers.

With the convergers, there was little difference between their third REM periods over the two studies. This fits the explanation based on traffic noise since only 1 convergent third REM period appears to have been affected in the original study and, as this period did not occur, it was not included in the analysis. In contrast, the convergers' fourth REM periods produced a difference of 15.4 minutes between the original and replication studies. As all 3 convergers who experienced the traffic in the original study seem to have been affected during their fourth REM periods, this is not too surprising; particularly, as 1 of these 3 convergers had only one fourth REM period lasting a mere 7 minutes which was, therefore, his average, and a second converger who had no fourth REM period in the original study (and, therefore, no average) produced the longest convergent fourth REM period in the replication. If, in the original study, the converger with the one 7-minute fourth REM period is excluded and the 2 other affected convergers are credited with their average fourth REM period duration on traffic-free nights, then the convergent group averaged 31.9 minutes for their fourth REM period in the original study as against 38.3 minutes in the replication, statistically an insignificant difference.

Divergers were apparently affected during both their third and fourth REM periods during the original study, and this is reflected in Table 6.5. If disrupted REM periods in the original study are credited with their assessed losses, the mean duration of the third REM period increases to 30.0 minutes as against the 35.4 minutes spent in this REM period during the replication, again an insignificant statistical difference; and adjusting the only divergent fourth REM period disrupted in the original study gave a mean fourth REM period duration of 41.4 minutes in the original study, identical to the fourth REM period in the replication.

If, in the original study, the corrected values of disrupted REM periods are substituted, the difference in length, in Table 6.5, between convergers and divergers' third REM periods becomes statistically acceptable ($p=.09$, two-tailed) and remains so for their fourth REM periods, although at a reduced level ($p=.08$, two-tailed). Moreover, these adjustments in the original study increase the significance level of the convergent/divergent difference on the third REM period overall ($p=.016$, two-tailed) and leave the significance level between their respective fourth REM periods unaltered. It would seem that, when disrupted REM periods in the original study are adjusted, this accentuates rather than diminishes the differences between convergers and divergers in time spent in the third and fourth REM periods of the night.

# APPENDIX V11 :

## REM SLEEP PATTERNING AND MECHANISMS OF DEFENCE IN CONVERGERS AND DIVERGERS: A BIOCHEMICAL LINK?

This investigation has highlighted intriguing differences in the patterning of REM sleep displayed by convergers and divergers: and these differences have been attributed to their distinctive handling of threatening dream experience. But both physiological and psychological expression also echo biochemical events. As yet, we have said nothing of this 'third world', the biochemistry underlying sleep and dreams. To do so, of course, is to go beyond the research presented here. But if we are to complete the picture, however speculatively, it is to the biochemistry that we must turn.

That biochemical events are indeed involved in sleep is well illustrated by the following experiment. A cat may be selectively deprived of REM sleep for several days by placing him on a small support surrounded by water. The cat still has NREM sleep but not REM sleep, since the muscular atony which always accompanies REM sleep causes the cat to fall into the water and awaken. Following this deprivation, a long-lasting rebound of REM sleep (up to 60% of total sleep time on post-deprivation nights) occurs which may last several days depending on the amount of deprivation achieved. No mechanism, however sophisticated, belonging to short-term neurophysiology (synaptic potential) can explain this rebound phenomenon. Thus any theory of sleep must invoke biochemical mechanisms.

The identification of groups of neurones containing three monoamines - norepinephrine, dopamine and serotonin - in cerebral systems known to be involved in sleep has focused attention on these biogenic amines. A large number of studies have confirmed that the metabolism of these amines does play a role in regulating both NREM and REM sleep. For example, reducing the levels of all three amines in cats (by administering a single large dose of reserpine) suppresses NREM sleep for 12 to 14 hours and REM sleep for 24 hours (Delorme _et al_, 1965).

Subsequent research using more specific pharmacological agents has attempted to clarify the role of the individual amines. Decreasing levels of brain norepinephrine and dopamine without affecting serotonin levels (with alpha-methylparatyrosine) has been found to influence REM sleep in animals although there is some disagreement as to whether this procedure reduces REM sleep (Weitzman _et al_, 1969; Crowley _et al_, 1968) or increases it (King & Jewett, 1969; Hartmann _et al_, 1971b).[1] Although the dosages administered in these studies were similar in absolute terms, both studies that reported a decrease in REM sleep used monkeys whereas the two studies reporting an increase used cats or rats. This suggests that the different effects observed may be attributable to the relative dosages

1 As dopamine precedes norepinephrine on the same biochemical pathway, it is not possible to impair the synthesis or catabolism of dopamine without also affecting norepinephrine.

administered as, presumably, the levels used represent a less acute dose for the monkey than for either the cat or rat. In support of this, a further study with cats reported an initial decrease in REM sleep followed by an increase (Iskander & Kaelbling, 1970). Selectively impairing the synthesis of norepinephrine alone (with Disulfiram) has also been found to suppress REM sleep in cats (Jouvet, 1969). The conclusion that norepinephrine is involved in the regulation of REM sleep is strengthened by the observation of an increased turnover of cerebral norepinephrine during the rebound of REM sleep following its selective deprivation in the rat (Pujol _et al_, 1968).

A more fundamental controversy surrounds the role of serotonin in sleep. Selectively inhibiting the synthesis of serotonin with para-chlorophenylalanine (PCPA) produces a profound insomnia (e.g., Delorme _et al_, 1966) and biochemical analysis has confirmed that the decrease in brain serotonin and the decrease in sleep go hand in hand (Jouvet, 1969). Moreover, an insomniac cat enters normal sleep (both NREM and REM) shortly after being injected intraperitoneally with 5-Hydroxytryptophan (5-HTP), a precursor of serotonin. These findings have usually been interpreted (e.g., Jouvet, 1969; Weitzman, 1969) as evidence of the involvement of serotonin in NREM sleep. However, Dement (1969) has shown that sleep gradually returns to normal over the course of about 10 days although the brain still lacks serotonin. To account for this, Dement suggested instead that the insomnia is a side effect of the disturbance brought about by the preceding emergence of pontine-geniculate-occiptal (PGO) 'spiking' into waking bahaviour.[2] Sleep returns because these freely-discharging PGO spikes appear to gradually lose their power to disturb the animal. Dement concluded that it is the loss of control of the phasic events normally associated with REM sleep that is the primary effect of reducing the level of brain serotonin.

In support of Dement's interpretation, the dissociation of tonic and phasic features of REM sleep has only been observed in studies that have lowered the level of brain serotonin. Moreover, restoring brain serotonin (with 5-HTP) in cats previously given reserpine or PCPA promptly suppresses the freely-discharging PGO spikes (Delorme et al, 1965; Dement, 1969).[3] Although the tonic features of REM sleep seem to be dependent on norepinephrine levels, it is possible that serotonin levels - by regulating phasic discharge - also indirectly influence time spent in REM sleep. For REM sleep rebound has only been observed in studies in which phasic as well as tonic features of REM sleep have been suppressed: and Dement (1969) has confirmed that what determines the amount of rebound

2 These PGO spikes, observable in the EEG, are phasic features normally largely confined to REM sleep. When this phasic activity is discharged during the waking state, cats give every indication of hallucinating (Dement, 1969).

3 The restoration of brain norepinephrine and dopamine (with dopa) on the other hand, has no immediate effect on the uncontrolled discharge of phasic events, although tonic features of REM sleep return.

following REM sleep suppression is the accumulation of undischarged phasic events, not tonic REM sleep.

Brain Serotonin Levels and REM Sleep Patterning

Investigations with human subjects strengthen the suggestion that levels of brain serotonin may influence both tonic and phasic features of REM sleep. Bolstering levels of brain serotonin (with tryptophan or 5-HTP) increases both the duration of REM sleep and eye movement profusion within REM sleep (Mandell et al, 1964; Evans & Oswald, 1966; Hartmann, 1967; Wyatt et al, 1971a; Griffiths et al, 1972). Non-REM sleep seems to be unaffected in the majority of studies.[4] Duration of REM sleep is also positively associated with levels of 'free' tryptophan in plasma (Chen et al, 1974) which, in turn, may influence the concentration (e.g., Moir & Eccleston, 1968) and rate of turnover (e.g., Knott & Curson, 1972) of brain serotonin. Reducing brain serotonin by administering PCPA has had variable effects according to the level of dosage. A small but increasing dosage has produced a slight but consistent increase in REM sleep and a substantial decrease in the profusion of both eye movements and phasic integrated potentials (PIPs)[5]

4 Only one study seems in serious disagreement with these findings. Wyatt et al, (1970a) reported an increase in NREM sleep, but a decrease in REM sleep and eye movement profusion after the administration of tryptophan. Perhaps significantly, all 5 of their subjects were young women. The study might have been confounded by fluctuating levels of oestrogen, as these are known to influence the metabolic pathway of tryptophan (e.g., Rose, 1969). As REM sleep also decreased when tryptophan was given in conjunction with PCPA (to cancer sufferers), the investigators concluded that trytophan produced its sleep effects through a non-serotonin mechanism. However, this dosage of PCPA (2g/24 hours) would in any case be expected to decrease REM sleep (see below).

5 These PIPs are phasic features similar to PGO spikes in animals.

within REM sleep (Chernik *et al*, 1973).[6] Earlier studies, however, have reported a marked decrease in REM sleep in cancer patients after 2 to 3 weeks of a relatively high dose (2-4g/24 hours) of PCPA (Wyatt *et al*, 1969; Wyatt *et al*, 1971b).[7] On this dosage, a four-fold increase in the non-REM:REM ratio of PIP discharge was also recorded (Wyatt *et al*, 1971b). Finally, a small dose of 5-HTP given to a PCPA-treated subject has produced a significant increase in eye movement profusion within REM sleep but not in duration of REM sleep, whereas a larger dose did lengthen REM sleep (Wyatt *et al*, 1969; Wyatt *et al*, 1970b).

To summarise, it appears that increasing levels of brain serotonin above normal produces an increase in both REM sleep duration and eye movement profusion within REM sleep. Yet decreasing levels of brain serotonin by a relatively small extent also results in an increase in REM sleep, but with a decrease in the profusion of phasic features (eye movements, PIPs) within REM sleep. A further reduction in serotonin levels produces a decrease in REM sleep and a further decrease in phasic discharge within

6 This study in particular must be viewed with extreme caution as the data were collected from a single methadone addict during the course of his withdrawal programme. Nevertheless, it is interesting to note that, even in animal studies using large doses, "the first dose of PCPA has no observable effect, *except that the REM time is generally a little higher*" (my emphasis) (Dement, 1969).

7 A similar reversal of effect on the duration of REM sleep has been noted with different doses of reserpine. Whereas carefully controlled doses have increased REM sleep in man (Tissot, 1965; Hartmann, 1966b; Hoffman & Domino 1969; Coulter *et al*, 1971), larger doses in animal studies have suppressed REM sleep (e.g., Delorme *et al*, 1965).

REM sleep (at least relative to NREM sleep). Finally, a still more acute reduction in serotonin (in animal studies) leads to a loss of sleep altogether.

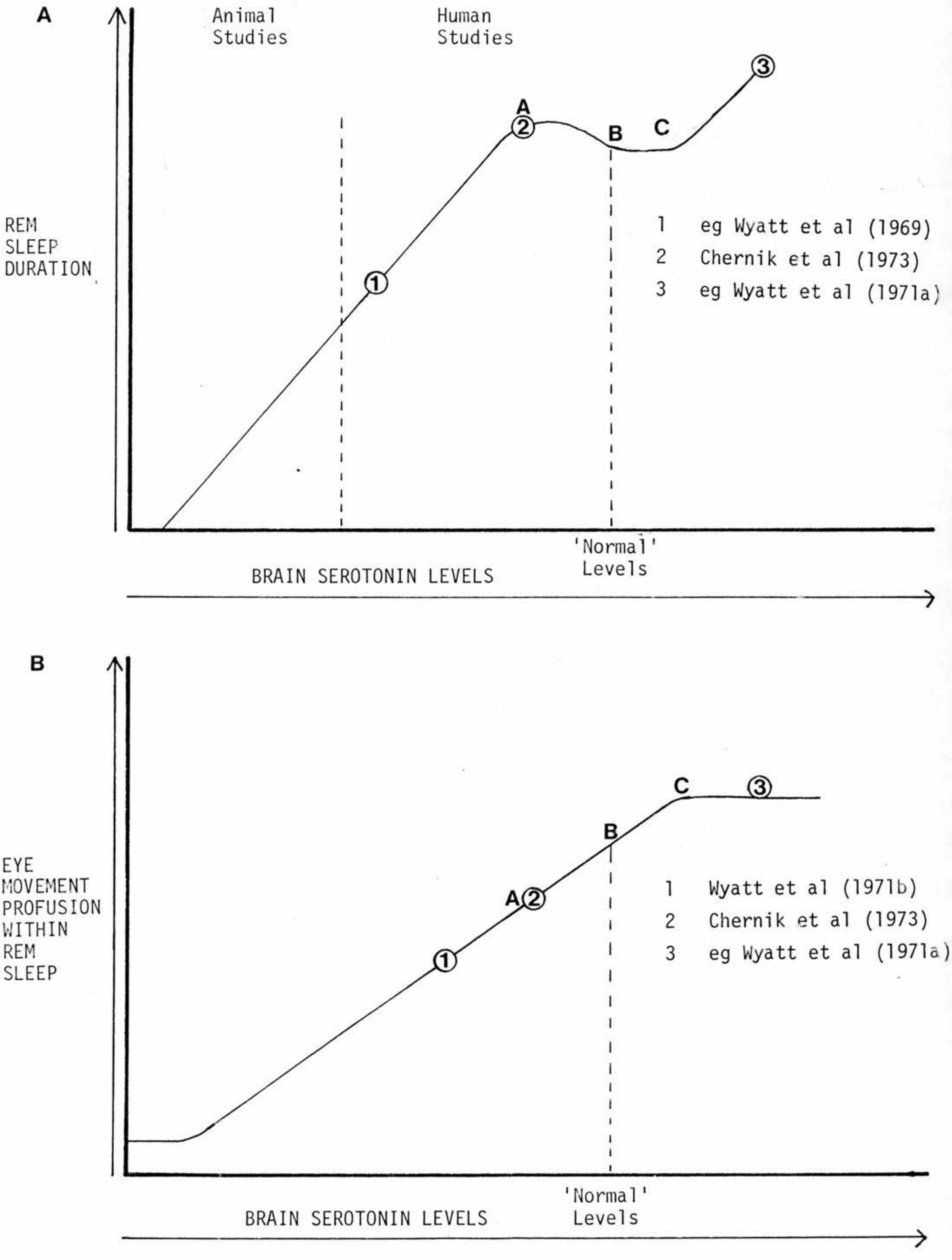
If we accept the following assumptions, these apparently contradictory findings may fall into place:

1. Increasing (or decreasing) the level of brain serotonin results in more (or less) rigorously controlled phasic expression, which takes the form of a temporal compression (or dispersion) of these phasic events (after Dement, 1969);
2. There is an upper limit to the compression of phasic events;
3. Phasic events trigger and maintain REM sleep, but as they become increasingly dispersed they gradually lose their power to do this; and
4. Increasing (or decreasing) brain serotonin levels increases (or decreases) the incidence, as well as the compression, of phasic events within REM sleep.

First, consider the effect of raising serotonin levels. With a small increase, REM sleep may not alter as increased phasic discharge is counteracted by increased compression. Alternatively, if the compression of phasic events outstrips their increased incidence, REM sleep may shorten. However, once the postulated ceiling level of compression is reached (Figure V11.1, point C), a further increase in the incidence of phasic events can only be accommodated by the expansion of REM sleep. A small decrease in brain serotonin levels (up to point A, Figure V11.1) produces a slight dispersion of phasic events, but

FIGURE VII.I

POSTULATED RELATIONSHIP BETWEEN BRAIN SEROTONIN LEVELS AND TONIC AND PHASIC FEATURES OF REM SLEEP



insufficient to seriously affect the ability of these phasic events to regulate REM sleep (in absolute terms, there was no increase in non-REM phasic activity in Chernik _et al_'s study). As a result, REM sleep may expand slightly to accommodate the increased spread of phasic discharge.[8] With further decreases in serotonin, greater dispersion of phasic events takes place resulting in a decreasing ability to trigger and maintain REM sleep (hence the four-fold increase in non-REM:REM phasic discharge). This interpretation also allows for the variable effects of different doses of 5-HTP given to PCPA-treated patients. A small dose of 5-HTP produced no increase in the duration of REM sleep because the increase in phasic discharge could be accommodated in a similar duration of REM sleep as the compression limit had not been reached. With a larger dose of 5-HTP, however, a greater increase in the incidence of phasic events could not be compressed into a similar duration of REM sleep.

If this interpretation is on the right lines, the effect of increasing or decreasing levels of brain serotonin will depend both on the amount of this increase or decrease and the existing levels of serotonin. According

8 There also appears to be a slight decrease in the incidence of phasic events. For there was a 26.4% decrease in percentage PIP discharge and an 18.5% decrease in percentage eye movement activity during REM sleep, yet only a 10.3% increase in the duration of REM sleep (Chernik _et al_, 1973).

to Figure V11.1, large increases or decreases will inevitably lengthen or shorten, respectively, the duration of REM sleep. Smaller shifts (in either direction) from normal levels, on the other hand, may produce a decrease, no change or an increase in REM sleep duration, according to whether changes in the compression of phasic events outstrip, keep pace with, or fall behind changes in the incidence of phasic events. As for eye movement profusion, increasing serotonin levels will increase profusion rates until the compression ceiling is reached; and decreasing levels of serotonin will decrease profusion rates below the compression ceiling.

One final point. In this discussion we have argued that phasic discharge and, as a result, REM sleep are influenced by shifts in the level of brain serotonin. This is not necessarily to suggest that it is the prevailing level of brain serotonin *per se* that regulates phasic discharge: it might equally involve the rate of synthesis or catabolism of serotonin.[9] In view of this, it seems least presumptive to refer to changes in the rate of brain serotonin turnover in pursuing the argument.

9 The three are, of course, mutually interdependent; existing levels of brain serotonin influence both rates of synthesis and rate of catabolism, as well as *vice versa*. (e.g., Ashcroft *et al*, 1969).

<u>REM sleep patterning, defensive orientation and brain serotonin turnover in convergers and divergers</u>.

On the above interpretation, the differences observed between convergent and divergent REM sleep patterns might be linked with different rates of brain serotonin turnover. The convergers' pattern of shorter, more intense periods of REM sleep suggests that they turn over serotonin at a higher rate during REM sleep than do divergers. Perhaps most striking, the convergent pattern of a short REM latency along with a relatively long, intense first REM period of the night is precisely the effect produced by feeding subjects tryptophan prior to retiring (Oswald <u>et al</u>, 1964, 1966; Evans & Oswald, 1966; Griffiths <u>et al</u>, 1972). Is there any reason for hypothesising that convergers might indeed turn over more serotonin during REM sleep than divergers?

Increasing the rate of brain serotonin turnover also affects waking behaviour. Administering 5-HTP or tryptophan produces slight euphoria, a mild feeling of drunkenness and a tendency to lewd conversation (Oswald <u>et al</u>, 1966) and has even led to complaints from nursing staff (Smith & Prockop, 1962). This suggests that brain serotonin turnover is associated not only with phasic discharge but also with drive expression whether in dreams or while awake. But the convergers' life style suggests a primary repressive orientation toward drive expression during the day.[10] This inhibition may be reflected, at a biochemical level, in a severe restriction of brain serotonin turnover while awake. If this were the case, then an accumulating need to turn over serotonin would build up during the day. This, in turn, would create a greater pressure to enter REM sleep so that this need might be safely discharged. Moreover, once in REM sleep, the very power of convergers' repressive handling of threatening dream experience makes it safe to allow relatively unrestricted drive expression and brain serotonin turnover. In other words, it is speculated that the convergent pattern of a short REM latency along with a longer first REM period is a response to the severe restriction imposed upon brain serotonin turnover by day and reflects more immediate serotonin turnover once asleep; and the night-long profuse eye movement activity within REM sleep expressed by convergers reflects relatively unrestricted brain serotonin turnover.

Divergers, too, presumably express more drive and turn over more brain serotonin during REM sleep than during the day. But the difference may be less acute than is the case with convergers. On the one hand, divergers' less rigorous defences may permit rather more day-

10 Primary repression refers to the inhibition of threatening psychic experience <u>before</u> it is expressed; secondary repression refers to the inhibition of psychic experience after it has been expressed. The phenomenon we have attempted to demonstrate in the present study is secondary repression - the expulsion of dreams from consciousness after they have been consciously experienced.

time expression of drive and this may be reflected in a less restricted turnover of brain serotonin by day. On the other, divergers' handling of dream experience may result in their still exercising more constraint on drive expression during dreams, and therefore brain serotonin turnover during REM sleep, than convergers. As a result, divergers experience less urgency to enter REM sleep than convergers and, when it comes, a slower rate of brain serotonin turnover generating less profuse eye movement activity.

In offering this account of how defensive mechanisms might influence, and interact with, the biochemical processes that appear to regulate REM sleep patterning, we have gone some way beyond evidence that is, in itself, fraught with difficulty. For interpretation of pharmacological data is based on an assumption that may often prove unjustified: that the only relevant effect of drug intervention is the one being measured. The intimacy of biochemical processes - among themselves and with physiological systems - makesthis a fragile assumption. It may be premature to try and make sense of data generated by research still in its infancy. The justification - if there be one - of indulging in speculation must be that, far from proving idle, it may serve to sharpen the attack of future research in this area.

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